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Recent Improvements in the Golden Cycle Cyanide Mill

By L. S. Harner

Concluding installment of

Exploring for Ore by Potential Methods

By E. G. Leonardon and Sherwin F. Kelly

Biographical Sketch of Francis L. Bosqui

Reviews of Mining in Nevada, Idaho, Colorado, Montana, Washington, Oregon, and Utah—The Zinc Situation Explained by W. R. Ingalls—The Aerial Map of the Tri-State District—World Lead Output To Be Controlled?—The Status of Mining, by T. A. Rickard

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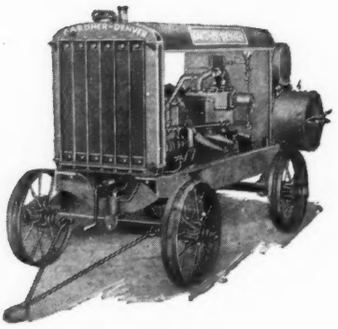

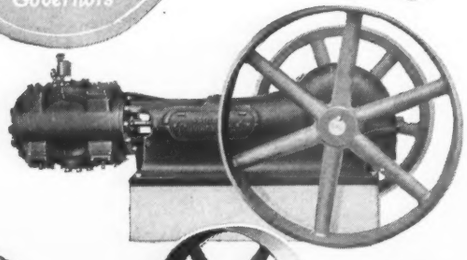

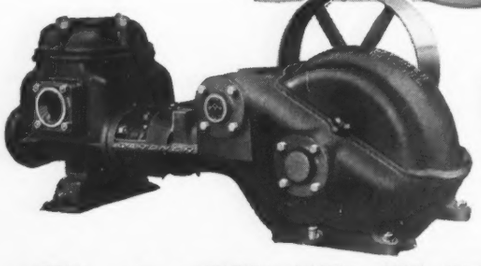

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Research Has Lagged in Amalgamation Practice

ATTENTION has been paid in recent years to the adoption of concentration of gold-ore pulp on blanketing or corduroy, but this does not necessarily imply the displacement of amalgamation. The gold in the concentrate produced must be recovered, and mercury forms an efficient vehicle for this purpose. However, it is the underlying principle of impoverishment of pulp prior to cyanidation, rather than the application of any process such as amalgamation, that justifies attention and research.

Some few years ago Messrs. K. L. Graham and F. Wartenweiler demonstrated that grinding of all gold to minus 260 mesh is necessary to insure an efficient extraction by normal slime-treatment methods. Amalgamation, although still an important process for the recovery of the world's gold, is and always has been divorced from research. For half a century or so the use of clumsy copper plates has persisted, and no significant advance in the application of the process has been recorded in that period. The scope of centrifugal amalgamation has yet to be demonstrated in a convincing manner. The adoption, or rather re-adoption, of blanket or corduroy concentration is a logical step, whereby amalgamation can be restricted to a high-grade product. Closer control is thus possible, with lower mercury losses, reduction in poison hazard, and less likelihood of theft. But the whole subject of the status of amalgamation as a logical step in the treatment of a gold ore has been obfuscated by a neglect to realize that blanketing is but one phase of a process adopted to effect the same result, in which mercury is also used, and in which amalgamation is also practiced, for the recovery of the gold.

In a professional society publication not long ago an engineer commented on the use of blankets in place of plates in India, looking upon "blanketing as coming to the fore and displacing amalgam altogether. . . ." More confusion has resulted by introducing the factor of theft; the net result being that the impression is abroad that amalgamation plays and can play no significant rôle in the metallurgy of gold. The conclusion is reached that amalgamation has been dispensed with in the mines of India, whereas it has only been applied in a more logical manner—to a concentrated product. One paper gives complete details of current practice there: the pan amalgamation of the concentrate from the blanket tables, the residue from which is passed over copper plates. The gold in the blanket concentrate varies from 10 to 60 ounces per ton; the residue rarely exceeds four pennyweights.

Amalgamation has served its purpose as a valuable tool in the metallurgy of gold, but a tool that has never been sharpened. Research has been nipped in the bud by the constant reiteration of the statement that the process had passed into oblivion. It is more than probable that the time-honored method of application, using copper plates, will be entirely superseded in course of time. Amalgamation may, of course, be displaced completely as a result of research in other directions; but in any event it will have taught the lesson of the value of impoverishing a high-grade ore pulp before wet chemical treatment is commenced.

Aërial Photographic Mapping of Mining Districts

AËRIAL photographic mapping so far as the mining industry is concerned, has been almost entirely limited in application to extensive undeveloped and unprospected areas. In Canada, particularly, has such use been made of aërial photography, and with admirable results. Private mining interests—other than those possessing large areas of unprospected lands, like the Rhodesian Congo Border Concession, Ltd., which recently completed an aërial reconnaissance survey of 10,000 square miles and a detailed aërial map of 2,000 square miles in Northern Rhodesia—are generally unfamiliar with the possible value of aërial photographs and maps. In exceptional instances, a mining company has recognized the probable importance of an aërial map in the conduct of the company's affairs and its value to the particular mining district involved. Costs of preparing such a map, however, have invariably been prohibitive for the company to assume alone, and efforts to obtain the financial co-operation of other companies or interests in the same districts have usually been unsuccessful, owing to the lack of knowledge on the part of these bodies of the value of such a map to them. As a result of this general situation, the utilization of aërial maps has been extremely limited in not only the mining industry but also in the other industries of the country.

In bringing about the completion of an aërial map of a large portion of the Tri-State district, the Department of the Interior, besides providing a valuable administrative instrument for the U. S. Geological Survey and the Office of Indian Affairs, has given the mining industry of the country a new "yardstick"—one with which other mining districts may measure the probable value of such a map to them. The prediction is made that this broader adaptation of aërial photography in the mining industry will grow as its importance is more fully understood. Its rate of growth, however, will undoubtedly depend upon the financial co-operative effort of the varied interests in the different mining districts. When these interests are willing to finance jointly the preparation of an aërial map for their common use, more aërial maps will be available than there are today, and their importance in the various industries, including mining, will be more fully understood.

The Chrome Mining Industry and Leather Research

THE RECENT announcement by the Tanners' Council of America that a fund of $1,000,000 is to be raised for research sets a precedent for other industries that might also place programs for industro-scientific investigation beyond the influences of fluctuating market conditions and make them independent of the effects of temporary depressions. History shows that, in times of commercial stress, the first economy proposed involves the emasculation of the powers and scope of the research department to a point inhibiting satisfactory progress or appreciable discovery.

About 50 per cent of the sodium bichromate produced in this country is absorbed by the leather industry, and almost all of this is manufactured from imported ore. Last year the development of deposits of chrome ore in Montana was announced, with plans to manufacture ferrochromium and the bichromates. The recovery of the latter involves excessively fine grinding prior to roasting, and the lixiviation of the mass. Opportunity for improvements and economies in the manufacture of bichromate would seem to lie in the direction of a more efficient leaching process and a higher recovery of the valuable soluble, by the application of modern methods of solution displacement and the progressive enrichment of leach liquors.

The expense incurred in evaporation may be avoided to some extent, it is thought in some quarters. Attention certainly should be paid to the possibility of the introduction of more economical and more automatic methods of crystallization. As a result of research, and by reason of the attention that might well be paid to these phases of bichromate manufacture, it may be possible to utilize lower-grade ores, or at least to indicate how such ores may be beneficiated in the event of a pressing and urgent need, such as might be created by a national emergency.

During the war a government regulation insisted on the purchase of imported and domestic chromite ores on a 50-50 basis. Manufacturers in the eastern United States were prosperous enough to be able to discard the domestic ores they had to purchase under this regulation, arguing that they were insufficiently high grade and that a modification in treatment method would be necessary if they were to be used.

Between the period covered by the years 1896 and 1915, the United States chromite production amounted to but a few hundred tons per annum. In 1918, war demand stimulated domestic production, and over 80,000 tons was mined, mostly in California. Shortly before and after the armistice the price sagged, and foreign ore has since provided the raw material for several American industries. No organization of chrome-ore producers, so far as is known, has been formed in the United States.

If the chromite mining industry in the United States is to be resuscitated to some degree at least, so that research may not remain in abeyance, recognition must be given to the fact that the domestic ores are suitable for beneficiation, as was proved in the western United States during the war. The preference shown by manufacturers for high-grade ore is merely a natural preference that has been in evidence in every industry using and processing raw material. However, let it be noted as a general rule that technical advance, economy, and precision in metallurgical practice have been achieved almost entirely as a result of research on low-grade ores, and that efficient recovery and low-cost production are seldom practiced nor their possibilities gaged until lean ores only are available.

The complete or, at any rate almost complete, recovery of a valuable soluble from a valueless gangue, rocky or earthy, has been attained by metallurgists and by the application of hydrometallurgical methods. That sufficiently cheap bichromate can be produced from domestic ores by such methods can only be proved by a program of research such as is proposed by the Tanners' Council of America.

Welding and Cutting in the Mining Industry

CUTTING STEEL by saw or chisel is a slow and tedious process. Joining steel parts together by riveting also has disadvantages. One of them is that the holes made for the rivets weaken the plate. Repairing broken castings has often been impracticable, if not impossible, and many a shutdown, caused by the failure of a critical machine on this account, has occurred in the history of mining operations. Worn shafting and other worn machine parts have usually found their way to the scrap pile, save in those instances where the company had its cupola, or a profitable market for such scrap metal as was produced existed close at hand.

Formerly no remedy existed for these difficulties. Today the situation is quite different. Cutting or welding, by gas or electric current, has brought about this change. Steel may now be cut "like cheese." Broken parts may be quickly welded so that they are as good as new, or better. In fabrication, riveting is giving way to welding, not only in the manufacture of machinery but in the erection of buildings. Worn shafting can be built up with the welding rod and then turned down to the exact diameter wanted. In short, the uses for welding and cutting equipment have multiplied exceedingly and are on the increase. The place it has made for itself in the shops and plants of several of the largest mining companies operating in North America is sketched in an article in the Industrial Progress pages (171 and 172) of this issue.

Boll Weevil Hibernation and the Arsenic Market

PRESENT and prospective producers of arsenic may find some—but only a little—ground for encouragement in the report from the U. S. Department of Agriculture that the number of boll weevils hibernating this winter in the cotton fields of the South is unusually large. This indicates that if climatic conditions favor the weevil—that is, if next summer is cool and damp—the pest may assume alarming proportions, requiring a large amount of arsenical poisons for its control. There is no assurance of such weather, however; in 1923 and 1926, the weather was "favorable," but the comparatively hot dry summers of 1924, 1925 and 1927 made it unnecessary to take unusual precautions against destruction of the cotton

crop. In any event, arsenic producers are not in any particularly favorable position, for the reason that, even if the weevil pest becomes of real importance, only a small proportion of the cotton acreage is likely to be treated, for the good and sufficient reason that adequate stocks of the poison will not be available. No private agencies are willing to take the risk of carrying large stocks of insecticides for several years, and when the call comes it is for immediate delivery; if the poison is not available, it is not used. It would appear to the man in the street that, if the United States government is to consider the expenditure of about three-quarters of a billion dollars for new warships, it might with much more reason cogitate the matter of an appropriation of four or five million dollars for a stock of 25,000 tons or so of arsenical insecticides, the money of course, being returned to the Treasury, with interest, when conditions became such that the stock would be sold. Thus would a step forward be taken, not only in improving the conditions of cotton production but also in the stabilization of the arsenic market, doing away with such exteme ranges in price as 2¾ to 16 cents per pound, which figures have marked the limits of the white arsenic market in the last five years. Total stocks of arsenic in the United States at present are probably between 3,000 and 4,000 tons—an amount entirely inadequate to meet any sudden demand from insecticide manufacturers. And at 4 cents per pound there is no incentive to produce, the present output coming from plants in which it is a byproduct, the tonnage of which is held at as low a figure as is economically possible.

Recent low prices for arsenic have had one advantage —they have stimulated research in new uses for the material. Of greatest potential importance at present is the work being done in the field of its use as a wood preservative underground, as for posts and telegraph poles, the arsenic being inimical alike to animal and fungus growth.

Mining Initiative Abroad Meets Obstacles

THE experience of Mr. Charles Butters with revolutionists in Nicaragua exemplifies the difficulties that sometimes attend the operation of mines abroad, where industrial development is usually so badly needed. Mr. Butters has been responsible for the development and operation of several mining properties in Nicaragua. The San Albino, after considerable difficulties, was brought to the producing stage, and hopes of profit were entertained. However, General Sandino, a former employee of Mr. Butters and a revolutionary leader, proceeded to use the mine as a base for operations and as a source of supplies and explosives, wrecking property and menacing life. Efforts made by Mr. Butters to retrieve his property were without result, and he finally returned to his home in California. Through the State Department he has filed claims against the Nicaraguan government; and it is hoped that he will receive adequate compensation for his losses. Such wreckage of a mining operation of promise is discouraging enough to its sponsors, but in a larger way it is most harmful to a country needing foreign capital. Political stability and adequate protection to life and property must be established, or industrial enterprise will fail to receive the financial backing or the initiative of capable men who are willing to pioneer foreign ventures.

Controlled Markets and Lower Prices

EFFECTIVE Jan. 1, 1928, the International Nickel Company announced a reduction in its base price for electrolytic nickel, from 39 to 37 cents per pound. During 1927 the Aluminum Company of America has lowered, in several steps, the price of aluminum, from 27 to 24.3 cents. In view of the fact that each of these companies is generally regarded as enjoying somewhat of a monopoly for the metals in the United States, speculation as to the reasons for the voluntary reduction is prompted. With respect to aluminum, the reason that appears on the surface is the competition of foreign metal. In spite of a tariff of 5 cents a pound, European manufacturers have been selling regularly at prices below that quoted by the Aluminum Company. Behind this, however, is the greatly increased production, notably in Canada, France, and Norway, and the need of the larger aluminum companies that have built these great modern works to extend the use of the metal into new fields and thereby to provide a market for increased output.

An equally ready explanation is at hand to account for the action of the International Nickel Company. The production of electrolytic nickel has been increased greatly recently, and costs have been reduced by the introduction of a process involving new features. As the development of the company's Frood mine proceeds, the production of fire-refined nickel metal gradually will be discontinued; and within a year, or perhaps two years, all the nickel will come from the electrolytic refinery. Incidentally, the Creighton ores will be reserved for the manufacture of Monel metal, as the nickel and copper in that deposit are in approximately the correct proportions. On the other hand, the Frood ore contains a larger amount of copper and also a higher content in precious metals, both of which characteristics make it more suitable for the production of metallic nickel by the electrolytic process.

For a great many purposes, electrolytic nickel is no better than fire-refined. Accordingly, the obvious manner in which to increase the demand for electrolytic is to narrow the premium over the other grade. The base price for ingot nickel remains at 35 cents per pound. Having, as it does, a virtual monopoly of the domestic business, it would be possible for the company to discontinue the production of any but electrolytic nickel and maintain the price at its present level—or even to raise it, for that matter.

The fact that it does not do so should not be construed as indicating an altruistic desire to help the consuming public. The officials of the International Nickel Company are successful so far as they increase the earnings of the company for the benefit of the shareholders. Nothing is more certain than that they expect to increase profits for their company by reducing the price of electrolytic nickel—not perhaps this year, nor even the second or third year from now, but in the long run.

One sees here a refutation of the contention that in a market where direct competition is lacking, prices necessarily will be raised inordinately. On the other hand, competition with other industrial materials that will serve the same purpose, and the ever-present urge to expand consumption, and consequently production, may easily result in lower prices even under conditions that appear to be monopolistic.

FRANCIS L. BOSQUI

Consulting Metallurgical Engineer

A BIOGRAPHICAL SKETCH

Based on an Interview

By H. D. KEISER

FEW AMERICAN metallurgists have received the international recognition that has been accorded F. L. Bosqui, who recently returned to the United States from South Africa. From the time of his early achievements in the adaptation of the cyanide process to the treatment of Western gold ores, his career, though not spectacular, has been an exceptionally individualistic one in the development of ore-treatment practice. An excellent technician, unbiased, and possessing keen powers of observation, his services have been eagerly sought in this country and abroad for the solving of many difficult metallurgical problems.

Mr. Bosqui's early life was spent in California, the family being numbered among the pioneers of the state. His father, a Canadian by birth, left Montreal in April, 1850, for the mining fields of California, and, a few years later, with Mr. Bosqui's mother, who was born in New York, established the family residence in San Francisco.

Following his primary and preparatory education in San Francisco, Mr. Bosqui entered the University of California, graduating in 1888 with the degree of Ph.B. He then matriculated at the College of Physicians and Surgeons in New York City—later incorporated with Columbia University—and received the degree of Doctor of Medicine in 1891. Such was his education—a rather unusual preparation for the career that followed.

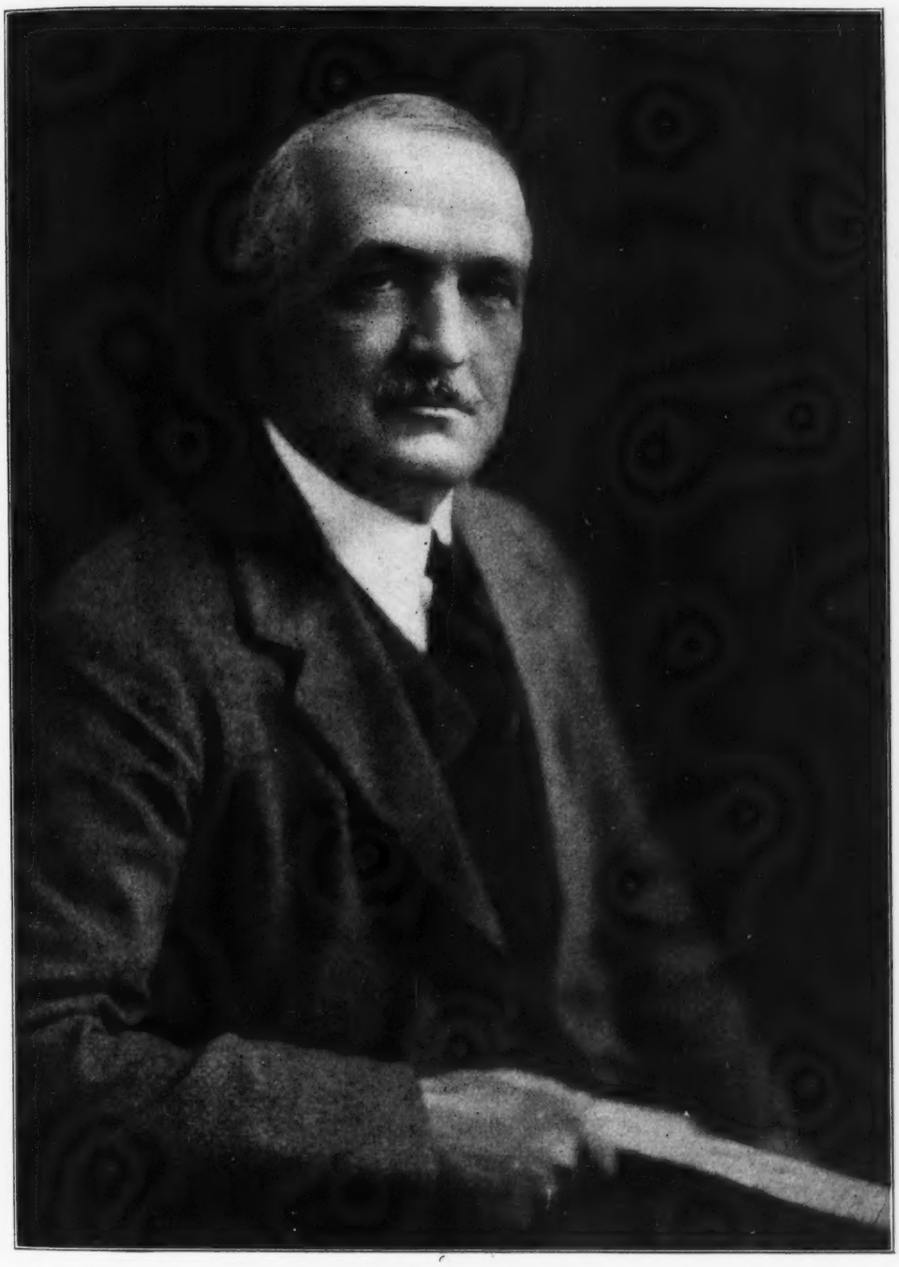
As a practicing physician Dr. Bosqui—who has since discarded the title—spent one year at Dayton, Wash., and then moved his offices to San Francisco, continuing to practice there until 1894. In the course of that year, while at Lake Tahoe with a patient, he met T. H. Leggett, then general manager of the Standard Consolidated Mine at Bodie, Calif. This meeting, besides being the beginning of a growing and enduring friendship between the two, marked a turning point in Mr. Bosqui's life work, for a few months later he accepted an offer from Mr. Leggett to join the staff at Bodie.

AT THIS time, C. W. Merrill had been engaged by Mr. Leggett to design a cyanide plant at the property of the Standard Consolidated, which plant was one of the first cyanide installations in the West. After a few months of association with Mr. Merrill, who assisted him in acquiring a knowledge of the principles and chemistry of the cyanide process, Mr. Bosqui, on Mr. Merrill's departure, following the completion of the installation, was offered the post of superintendent of the plant. This position he held for two years, later assuming the management of a second cyanide plant of the company. The latter was erected under the direction of Robert Gilman Brown, Mr. Leggett's successor, and, like the first plant, was a very successful undertaking. Besides having in his charge the management of these two cyanide plants, Mr. Bosqui also undertook considerable consulting work for other mining companies operating in the Bodie district. In 1897 he wrote and published a treatise entitled "Practical Notes on the Cyanide Process," one of the earliest works on cyanide practice.

In 1899 Arthur Winslow, general manager of the Liberty Bell Mining Company at Telluride, Col., engaged Mr. Bosqui to design and operate a cyanide plant to treat the tailing from the company's 40-stamp mill at Telluride. This plant was also a success from the start and led to the erection of a similar but larger plant under Mr. Bosqui's direction for the Smuggler-Union Mining Company, operating in the same district. In 1900 he erected a pilot plant and supervised cyaniding tests for the Camp Bird mine, at Ouray, Colo.

FROM 1902 to 1905 he engaged in consulting metallurgical practice in San Francisco, and during the latter year was appointed metallurgist to the Combination Mines Company at Goldfield, Nev. About this time he inspected a Butters vacuum-filter installation at Virginia City, Nev., and was so impressed by its possibilities that he designed and erected a small unit of 28 leaves at the Combination mine. The installation, which operated satisfactorily from the very beginning, was the first commercial Butters filter plant in the United States. When the Combination mine was merged with the Nixon-Wingfield interests into what became known as the Goldfield Consolidated, Mr. Bosqui continued as metallurgist for the new company. While holding this position he achieved his outstanding work in this country, when he devised the metallurgical scheme for the company's new 100-stamp mill. This mill, at the time, was one of the most modern ore dressing plants in the United States, embodying among its features the first large tube-mill and the first all-sliming installation. The ore, after amalgamation and fine grinding, was concentrated on Deister tables, and the cyanided tailing treated on a Butters filter. The mill was one of the first ore reduction plants in the country to be of steel and concrete construction throughout.

Significant as his achievements were at Goldfield, Mr. Bosqui's most important work was to be done abroad. In 1909, while on a visit to Europe, he met in London, through the good offices of Charles Butters, some of the



FRANCIS L. BOSQUI

leaders of the South African gold-mining industry. These meetings led to his acceptance, a few months later, of a consulting position at Johannesburg on the staff of Rand Mines, Ltd. In 1910 he was asked to reorganize the metallurgical staff of this group and was appointed its consulting metallurgist. During his six years' tenure of this position, Mr. Bosqui successfully revised in many ways the generally accepted metallurgical methods employed at that time in treating South African ores. This period marked the introduction of the Butters filter in place of intermittent decantation, and also cone classification for the separation of sands and slime, in line with the Merrill system in use at the Homestake mine, in South Dakota. He was largely responsible for the adaptation on the Rand of Nissen stamps; Pachuca agitators to replace the less efficient methods of agitation; Merrill zinc-dust precipitation; and the Dorr thickener. In brief, he, as far as possible, brought about a general infusion of American methods into South African metallurgical practice. In his achievement of materially reducing costs and increasing extraction on the Rand, it should be added that he was fortunately accorded a free hand by the progressive directorate of the Rand Mines, Ltd., in the introduction of these various improvements, and in the general reorganization of the reduction plants under his supervision. During the period of 1909-15 he also designed the metallurgical scheme for the 50,000-ton mill at the Modderfontein B mine, and for the second 60,000-ton plant erected by the New Modderfontein Gold Mining Company, Ltd., in which plant continuous treatment of slime, with the use of Dorr thickeners, was introduced, and the system of collecting the sands in superimposed tanks was superseded by the use of a common tank for collection and leaching. In 1915 Mr. Bosqui returned to England, and, while retained as a consultant by the Central Mining & Investment Corporation, incidentally gave his services for the establishment in London of a club and hospital for wounded Belgians, which was maintained entirely by contributions from Californians. In 1916 he joined the directorate of Chas. Butters, & Co., Ltd., and in 1919 went to New York to take charge of the American interests of that firm, which, in co-operation with the Central Mining & Investment Corporation, had undertaken to introduce the Tainton process in the United States. He remained in New York for five years, giving much of his time to assisting U. C. Tainton in the introduction of the latter's improvements in electrolytic zinc practice.

IN 1924 Mr. Bosqui took up his residence in Cornwall, England, and in January, 1927, was engaged by the Anglo-American Corporation to accompany its expedition to Queensland, in connection with the examination of the Mount Isa mines. On returning to Johannesburg, South Africa, several months later, he was engaged by the South African Townships Mining & Finance Corporation, in co-operation with other leading mining groups in Johannesburg, to undertake a series of trials and investigations in the United States, with a view to devising an improved metallurgical method for the recovery of platinum from the more refractory platiniferous ores of the Transvaal.

Recent Improvements in the
Golden Cycle Cyanide Mill

How New Devices and Machinery Have Lowered Costs at This Colorado Plant

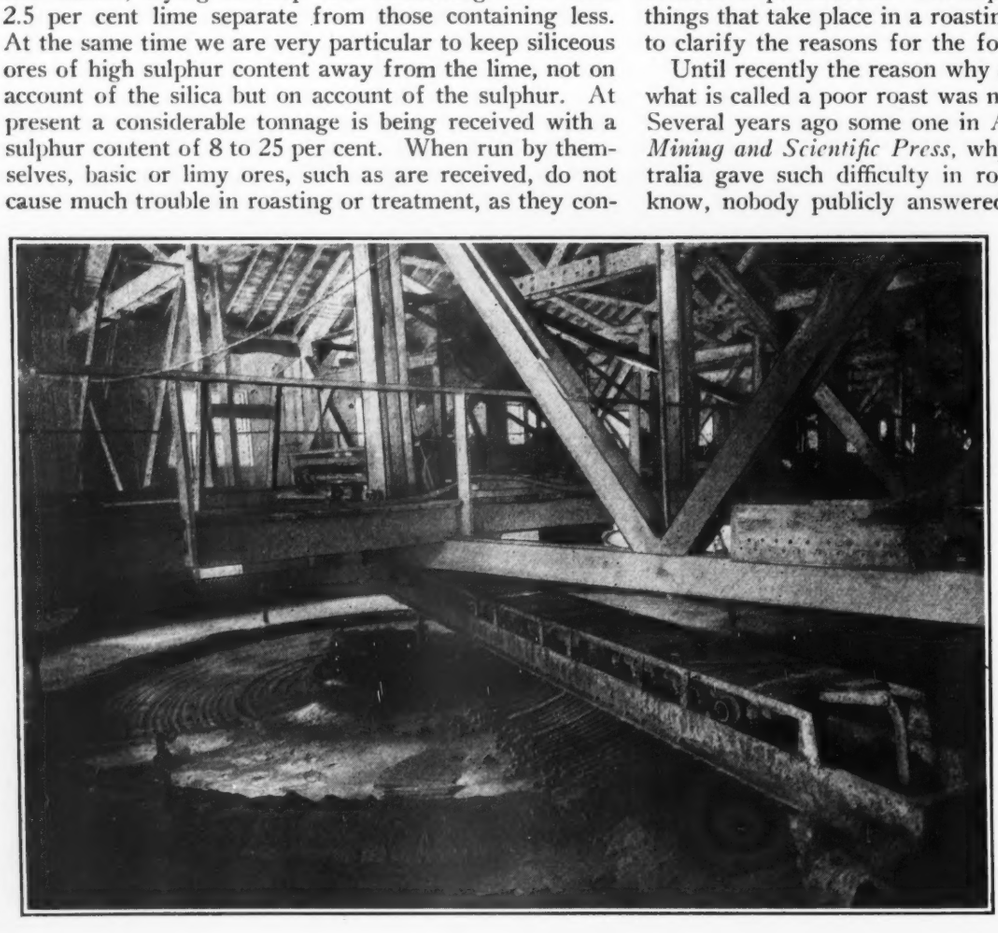
By L. S. HARNER

Manager, Golden Cycle Mining & Reduction Company, Colorado Springs, Colo.

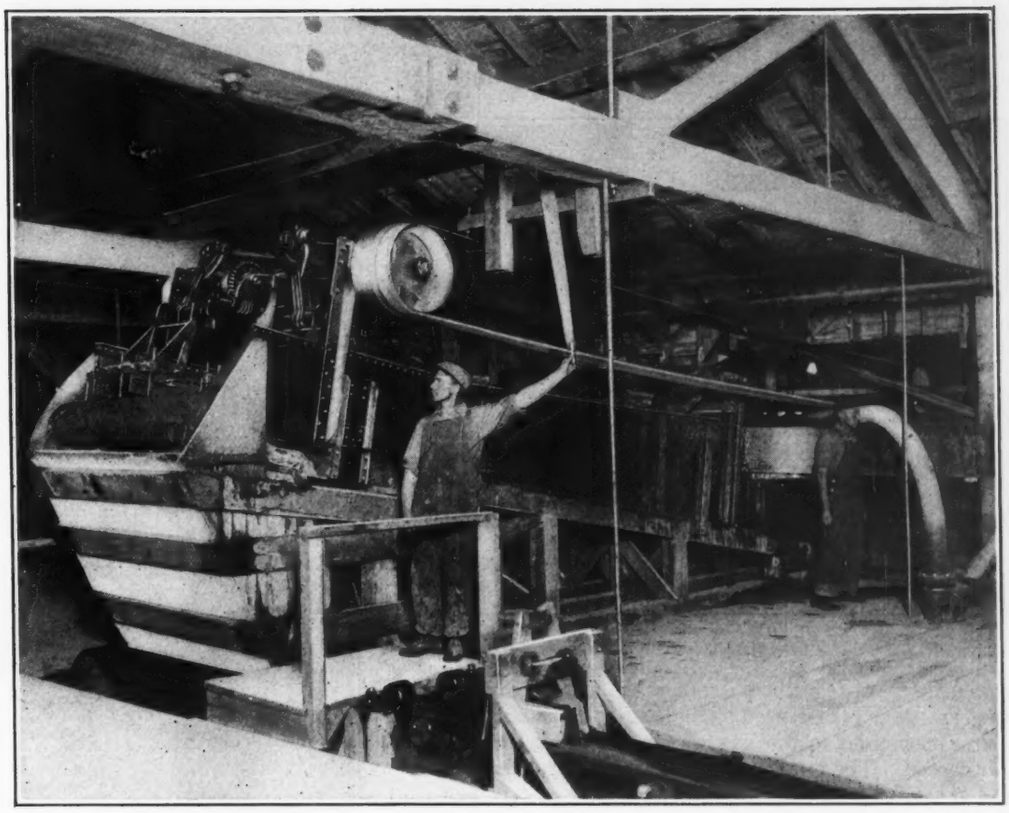
THE GOLDEN Cycle Mining & Reduction Company has been reminded several times of late that nothing has appeared in print regarding its cyanide mill since the publication of the Blomfield-Trott paper in the *Transactions* of the American Institute of Mining Engineers, in September, 1918. As the mill had been in successful operation eleven years when that paper was published, it is only natural that since then, changes in practice have been fewer.

As formerly, when there is room enough ahead in the storage bins, we divide the ore to be roasted roughly into two classes, trying to keep ores containing more than 2.5 per cent lime separate from those containing less. At the same time we are very particular to keep siliceous ores of high sulphur content away from the lime, not on account of the silica but on account of the sulphur. At present a considerable tonnage is being received with a sulphur content of 8 to 25 per cent. When run by themselves, basic or limy ores, such as are received, do not cause much trouble in roasting or treatment, as they contain only about 1.75 to 1.80 per cent sulphur. On the other hand, if ores containing 2 per cent or more of sulphur are mixed with the basic ores in the roasting, a great deal of trouble results. Under these conditions extraction falls off, chemical and zinc consumption increases, and all kinds of mechanical difficulties develop, owing to the deposition throughout the plant of calcium sulphate or plaster of paris and the formation in the solution of alkaline sulphides or iron alkaline sulphides that are very hard to get rid of, despite published testimony as to the ease with which they can be made to disappear when the aëration is pronounced. An explanation of some of the things that take place in a roasting furnace ought to help to clarify the reasons for the foregoing statements.

Until recently the reason why a basic sulphur ore gave what is called a poor roast was not generally understood. Several years ago some one in Australia asked, through *Mining and Scientific Press*, why the limy ores of Australia gave such difficulty in roasting, and so far as I know, nobody publicly answered. At any rate, at this



Distributor above one of the eleven 50-ft. diam., 600-ton steel tanks



Sand discharge from the bowl classifier

plant, part of the difficulty was discovered in a purely accidental manner. A CO_2 recorder, out of curiosity, was installed on the back end of one of the roasters, and this led rather quickly to letting the cat out of the bag. When the CO_2 recorder was first installed we were running on the siliceous ores, and it seemed to behave perfectly; but when we began running the limy ores, things started to happen. The CO_2 indicator began to climb and kept climbing until stopped by the physical restrictions of the instrument itself. Then and there, as far as we were concerned, the ivory was penetrated, and everybody thereabouts knew why it was difficult to oxidize sulphur in a basic ore and get what was called a sweet roast.

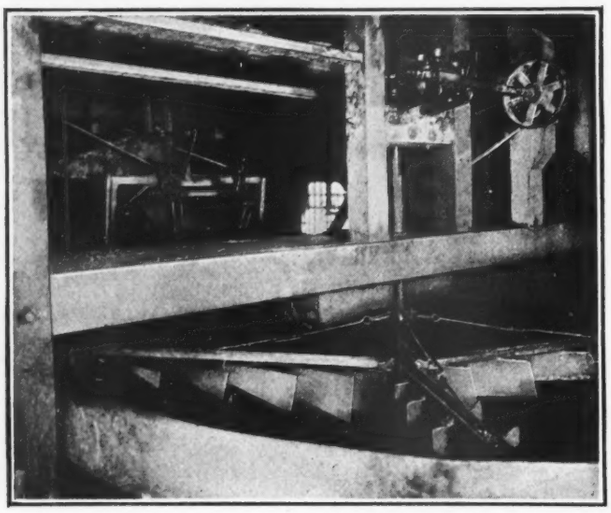
Roasting, as we were at that time, with a temperature on the head box of 850 to 900 deg. C., there was such a copious evolution of carbon dioxide that the air supplied was kept almost entirely away from the freed sulphur, thus precluding the oxidation of sulphur. Such conditions simply result in the formation of great quantities of sulphates and sulphides, with their attendant difficulties for the cyanide operator. At this juncture it was suggested we try lower roasting temperatures, the idea being to drive off and oxidize the sulphur at a temperature sufficiently low not to decompose the basic carbonates and thereby avoid the formation of the deleterious sulphates and sulphides.

Lowering the temperature to around 450 to 500 deg. C. seemed to be a success as far as the formation of undesirable chemical compounds was concerned. But, straightway, another difficulty arose—"out of the frying pan into the fire"—which so far as money in the bank was concerned, was quite as disastrous as anything that had gone before, if not more so. The new trouble arose from carbon in the roasted ore. Here some explanation is necessary. Ore cars going to Cripple Creek from the vicinity of Colorado Springs carry a great deal of lignite coal for use around the mines and for domestic purposes. Some of this lignite remained in the bottom of the cars which were loaded with ore and was discharged with the ore when unloaded. Added to this was the char thrown out of the engine stacks into the open ore cars, all of which found its way to the roasters. Roasting temperatures low enough not to break up the carbonates failed to burn this carbonaceous matter completely and left far too much of what practically amounted to a fairly good charcoal in the roasted ore. On the regrind in the Chilean mills this char was put into good physical shape to precipitate gold. This it did and caused a high residue in both the slime and sand plant. The sand plant suffered the most.

Without the interference of the carbon, this type of roasting had a great many of the earmarks of success. It not only required less coal but lessened firebox repairs and was much less damaging to rabble teeth, rabble arms, and roaster construction generally. The departure was worth while, however, for it not only helped keep the operating staff partly alive, but it was found that temperatures could be considerably reduced from 850 to 900 deg. and still most of the carbon would be removed or rendered innocuous, more of the sulphur would be oxidized, and on the whole the objectionable compounds heretofore noted would be lessened. Today we are heating to 700 to 760 deg. C. instead of 850 to 900 deg. C., and on the average we obtain better residues, combined with lessened coal and furnace upkeep expense. The above-noted "revelations"—and it may be that that is what they are—indicated that it might be desirable to exercise a closer control over temperatures than had been done before. So we installed Brown indicating pyrometers and recorders, which we found to be valuable aids.

While on the subject of roasting it would be well to take up the matter of the mechanical or screen classifica-

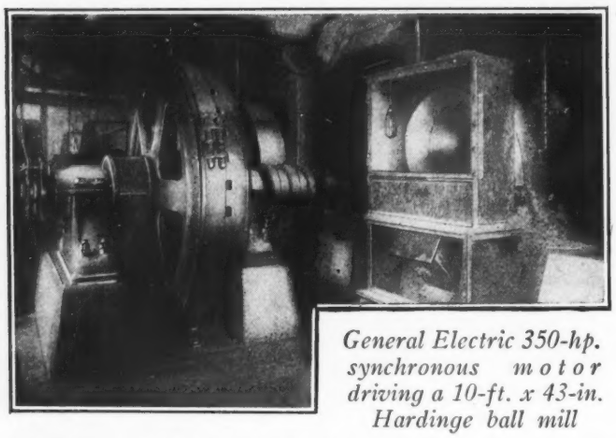
tion of the ore before it is sent to the roasters. Before roasting, the ore is quite coarse, 20 to 25 per cent remaining on a 10-mesh screen. For the last six or seven years the ore has been run over Mitchell or Hum-mer



Top of an 11-ft. Dorr bowl classifier

screens, separating the coarser than 10-mesh from the finer before it is delivered to the furnaces. The so-called coarse has gone to one set of roasters and the fine to another set. The temperature of the roasters treating the fine at this juncture was considerably lowered from that heretofore mentioned, whereas the temperature of the coarse ore was raised somewhat. But inasmuch as 75 per cent of the ore was classified as fine, the average temperature was considerably reduced. By this move the capacity of the roasters was raised about 10 per cent. The net result of the change has been increased tonnage, decreased temperature, less coal consumption, lower upkeep of the furnaces, and residues on the whole improved. This innovation has resulted in the saving of 100 lb. of coal per ton of ore roasted.

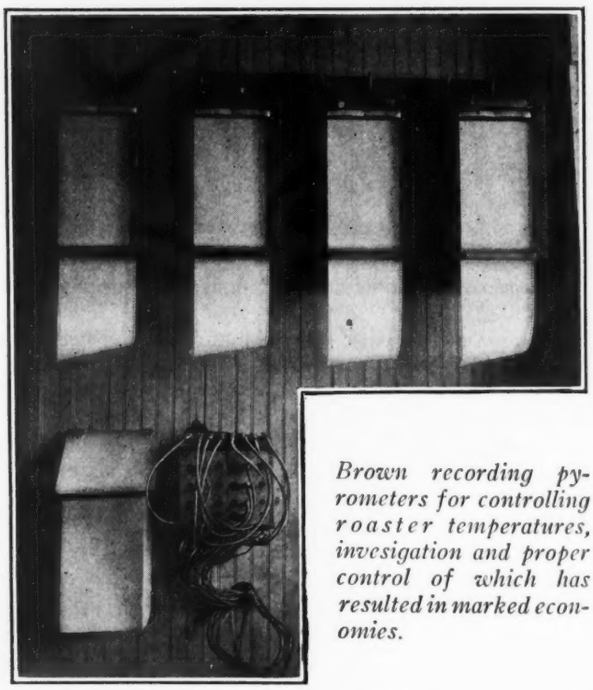
Our troubles, failures and successes were not confined to the roasters by any means. If my memory is not badly at fault, several years ago the Homestake, and some of the gold mills in Canada and South Africa, as well as ourselves, came to the conclusion almost coin-



General Electric 350-hp. synchronous motor driving a 10-ft. x 43-in. Hardinge ball mill

cidentally and independently that a small portion at least of the residue loss was due to the failure of the rather fine particles of free gold either to concentrate or completely dissolve during treatment. As is commonly known, the Golden Cycle mill practice is to regrind in Chilean mills to between a 16 and 20 mesh following the roasting, and then to run the ore over blanket tables, the blanket concentrate being amalgamated. On the tables we have tried woolen blankets, cotton blankets, corduroy, and some small test blankets of sponge rubber. At present, corduroy is in use, but none of these prevented the escape of small quantities of fine free gold too coarse to dissolve in the sand plant in the allotted time.

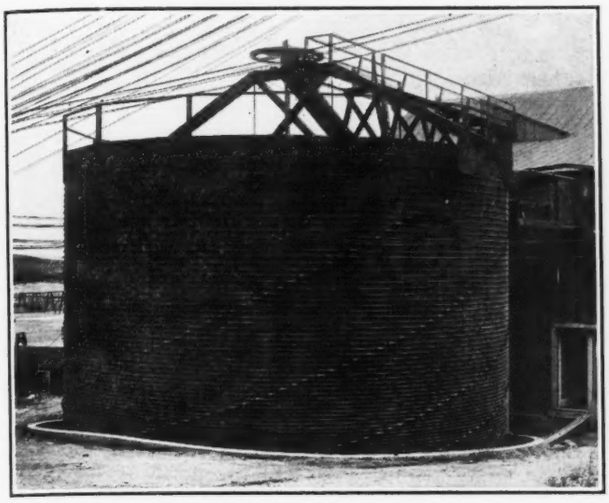
Classification is made in Dorr bowl classifiers. It had long been known that most of the free gold found in the sand plant was brought up through the raking compartment of the classifier, traveling on its bottom and near the center. The gold concentrate is discharged largely at the center. This was a matter, however, of no moment, but the fact that gold was on or close to the bottom at the point of discharge was of considerable importance. To meet what seemed to be the requirements of the case, a 2-in. slot was cut across the bottom of the classifier near the discharge end. Over this slot, and $\frac{3}{8}$ in. above it, flush with the back edge (calling



Brown recording pyrometers for controlling roaster temperatures, investigation and proper control of which has resulted in marked economies.

discharge of the classifier the front), a piece of sheet iron was fitted sloping gradually upward to the discharge. Incidentally, this dried the sand going to the leaching tanks. As will be readily seen, this arrangement resulted in cutting a thin slice off the bottom of the up-coming sand and dropping it through the slot. This portion contained the free gold and was returned to the blankets. In fact, the arrangement amounts to practically a closed circuit of the free gold of any appreciable size, so t is either caught on the blanket tables or is worn out and dissolved as it is forced round and round. The net result of this change, which cost practically nothing to make and operate, has been to reduce the sand losses from 6 to 9c. per ton, a reduction that is not to be sneezed at in these days of low-grade ores and the desirability or even necessity of lower treatment charges on custom ores.

Three years ago a Hardinge 30-ft. sand clarifier was installed. This machine has given excellent satisfaction



A 36x21-ft. Dorr agitator

from the start. No mechanical or other difficulties have been experienced, and the solution for precipitation is always exceptionally clear. As all solids are removed, the product to be melted is lessened and refining costs are correspondingly reduced. Zinc consumption is less and the grade of bullion better than when a canvas clarifier was in use. As installed, the clarifier will handle 3,500 to 4,000 tons of solution per 24 hours, as it is pumped from a Butters type filter plant. The cost of operation is almost nil under conditions here.

One thing should be mentioned regarding the mullers and dies used in the Chilean mills. With a feed and discharge such as is required, these wearing parts cupped or became concave very rapidly, a feature which reduced the duty of the mills greatly and increased power consumption. After a certain amount of wear, the custom was to remove the mullers and dies, cart them to the machine shop, and machine them to a level face—a time-consuming and costly way, considering the benefits derived. It was suggested that an electric welder be used to fill in those deeply cupped and corrugated surfaces. This was done and succeeded beyond the most sanguine expectations. When refilled, the surfaces had six times the wearing capacity of the original steel, and as the refilled part wears away a refilling is repeated on the same old stock. How many distinct repairs can be made in this way on the original steel is not yet known, but some of the surfaces have been renewed four to six times, and the stock still looks good.

It has been suggested that something be said about the dry-grinding plant where the ore is ground comparatively fine. Operation in this department has never been quite satisfactory; consequently it is always in a state of flux. Right now we are in the midst of changes from which considerable help is expected. At present this grinding is being done by Kominuters and a 10 by 4-ft. Hardinge mill. The difficulty at all times is to get these mills to discharge the ore as rapidly as desired. The mills apparently will grind a good tonnage, but do not pass the material horizontally fast enough to prevent overgrinding, so the tendency is for them to fill up with fine material. Bear in mind the fact that the feed carries from 3 to 4 per cent moisture and is somewhat sticky. All in all, we are not quite satisfied with the present arrangement and are going to try something different. The Hardinge mill will still be kept to finish the small amount of oversize that is expected.

A partial summary of accomplishments is as follows:

1. The roaster feeds have been classified and the temperature has been lowered.
2. Coal consumption has been lessened.
3. The reason for the difficulty in bringing lime-sulphur ores to what is known as a sweet or oxidized roast is better understood.
4. Residues from the sand have been lowered by better handling of fine free gold.
5. Chilean mill consumption of steel, and labor requirements have been greatly reduced and costs lowered.
6. Better-clarified solution has been obtained.

Credit for betterments are due to the co-operation of the entire staff combined with the help of the mechanical department and some of the general workmen as well.

Output of Utah Mines in 1927

THE mines of Utah in 1927 produced gold, silver, copper, lead, and zinc valued at $74,348,000, a decrease of about $8,315,000 from the output of 1926, according to estimates by the U. S. Bureau of Mines. A large increase was reported in gold and slight ones in copper, lead and zinc, but the output of silver was less than in 1926. The smelting plants at Murray, Midvale, Garfield, and International were active, and several new and important producing mines were added to the list for 1927. A marked decrease, however, in the average metal prices of silver, copper, lead, and zinc seriously affected many of the large operators. Utah was first in the United States in the production of silver, second in copper after Arizona, and second in lead after Missouri. The custom flotation mills at International, Midvale, and Bauer were operated the entire year, and improved milling plants were run at Park City and Bingham, but the Chief Consolidated flotation plant at Eureka was idle most of the year.

Production of Gold Increases Considerably

Gold production increased considerably from $3,778,046 in 1926 to about $3,986,300 in 1927. Practically all the gold was recovered from ores and concentrates smelted. In general the mines of the Park City district showed a marked increase in output of gold, and gold from the Bingham region was greater, but the Tintic district showed a large decrease. The largest producers of gold were the Utah Copper, Park Utah Consolidated, United States Smelting, Refining & Mining, Mammoth tailing dump, Utah Delaware, Utah-Apex, Chief Consolidated, and Tintic Standard properties. Pronounced increases in gold were made by the Utah Copper, Park Utah, North Lily, Silver King Coalition, Victoria, Bluestone (Stockton Lead), Bingham Metals, and Eureka Lily properties.

Value of Silver Output Decreases Nearly 12 Per Cent

The silver output decreased from 19,358,581 oz. in 1926 to 18,800,000 oz. in 1927, but the production was 7,700,000 oz. more than that of Montana, which was second in silver production in the United States. The value of the silver output decreased from $12,079,755 to $10,659,600, or nearly 12 per cent, due in part to the decrease in the average price. Silver production from the Park City region was increased considerably in 1927,

but that from the Tintic and Bingham districts was less. The Park Utah Consolidated Mines Company, operating mines at Park City and Keetley, was the largest producer of silver in Utah, and even reported a slight increase. Next in order come the Tintic Standard Mining Company, the Silver King Coalition Mining Company, Bingham Mines Company (including Victoria), the Chief Consolidated Mining Company, and the Plutus Mining Company. Other large producers were the Utah Copper, United States, Ontario, Utah-Apex, Utah-Delaware, Mammoth, Mammoth tailings, and North Lily properties. Decidedly increased production was made by the Silver King Coalition, Park Utah Consolidated, Victoria and North Lily mines. The output of the Chief Consolidated mine at Eureka was comparatively small, as the flotation mill was run only three months, but ore shipments from the eastern part of the Tintic district have in part made up the deficiency, and ore much richer in silver was shipped from the Silver King Coalition property at Park City, the result of an important strike made during 1927. The unusual increase in silver from the Victoria mine at Eureka was also due to the opening of a new orebody.

Output of Copper Higher, but Value Less

Production of copper increased from 257,464,482 lb. in 1926 to 258,300,000 lb. in 1927, but the value decreased from $36,045,027 to $33,579,000. The final figures may show some variation, possibly a slight decrease, but Utah was second in copper production after Arizona and was far above Montana in 1927. The Utah Copper Company at Bingham produced 20,000,000 lb. of copper a month the first half of the year, but later reduced the rate of production, so that the output of the year was slightly less than that of 1926. The recovery in copper concentrate was increased to about 90 per cent of the copper in the mill ore, and the grade of the concentrate was greatly improved. There was a substantial increase in copper from the Utah-Apex and Utah Delaware mines at Bingham and from mines at Park City, but the output from the Ohio property, at Lark, was virtually the same as in 1926. In the Tintic district the decrease in copper was general, owing in part to the fire at the Mammoth mine.

Value of Greater Lead Production Shows Decline, Owing to Lower Prices

The lead output increased from 295,270,025 lb. in 1926 to 297,900,000 lb. in 1927, but the value decreased from $23,621,602 to $20,107,000 as the average price declined. The lead-smelting plants were active, but not worked to capacity, although bullion shipments from International were increased. Unusually large decreases in lead were reported from the Utah-Apex mine, at Bingham, and the Chief Consolidated mine, at Eureka, and several smaller mines were affected adversely by the drop in the price of lead. The encouraging features of the year were the opening of new ore and greatly increased shipments from the North Lily and Eureka Lily, at Dividend; the Park Utah Consolidated, at Keetley, the Victoria and Plutus mines, at Eureka; the Silver King Coalition, at Park City; and mines near Stockton. Three large custom flotation plants were operated continuously, but the Chief Consolidated mill at Eureka was closed in March. The Park City region showed a decided increase, as did the Rush Valley district of Tooele County, but the lead output from the Tintic district and Big and Little Cottonwood districts was less. The largest producers of lead in their order of output were the Park Utah Consolidated, Tintic Standard, Silver King Coalition, United States, Utah Delaware, Utah-Apex, Bingham Mines (including Victoria), Plutus, Chief Consolidated, North Lily, Bullion Coalition, and Stockton Lead (Bluestone) companies.

Zinc Recovered Probably Increased Slightly

The zinc recovered, chiefly from concentrate leached or smelted, probably increased slightly from 95,179,380 lb. in 1926 to about 95,800,000 lb. in 1927. As the average price was much less than that of 1926, the value decreased from $7,138,454 to $6,016,240. All the large flotation mills in Utah treating lead-zinc ore—International, United States, Combined Metals, Silver King Coalition, Utah-Apex, and Chief Consolidated—were operating in 1927, but the Chief Consolidated mill was idle nine months. There was a large increase in mill ore from the Park Utah Consolidated property, which made it the leading zinc producer of Utah, but a marked decrease was reported in zinc recovered from the Chief Consolidated and Utah-Apex properties. At Park City the Silver King Coalition property marketed more zinc concentrate, and several mines at Bingham, notably the Bingham Mines, Park Bingham, Utah Metal & Tunnel, and Utah Copper, produced much more zinc milling ore. There was no serious change in the zinc output of the Utah Delaware mine and the United States property at Bingham, which was the leading producer of zinc in 1926. The largest zinc producers were the Park Utah Consolidated, United States, Utah Delaware, Silver King Coalition, Utah-Apex, Bullion Coalition, Ontario, Bingham Mines, and Utah Metal & Tunnel Company. Zinc was about equally divided between the Park City and Bingham districts, with a little from the Tintic district and Tooele County.

Total Ore Produced by Mines of State Exceeds 1926 Tonnage

In 1927 the mines of Utah produced about 16,036,000 tons of ore, an increase from 15,856,144 tons in 1926. Of this total the Bingham district produced about 14,565,400 tons, compared with 14,521,472 tons in 1926. The estimated production of the district was 122,510 oz. of gold, 3,447,000 oz. of silver, 248,777,000 lb. of copper, 103,871,000 lb. of lead, and 48,290,000 lb. of zinc.

The mines of the Tintic district produced 435,500 tons of ore and old tailings, as compared with 543,902 tons in 1926. Estimated production of the district was 33,000 oz. of gold, 7,627,000 oz. of silver, 3,634,000 lb. of copper, 90,934,000 lb. of lead, and 811,000 lb. of zinc. The mines that produced more than 10,000 tons of ore during the year were the Tintic Standard, Chief Consolidated, Plutus, Eagle & Blue Bell, Victoria, Mammoth, and North Lily. The Tintic Standard Mining Company was the second largest producer of silver and lead in Utah, but the output was slightly less than in 1926.

Shipments of ore, concentrate, and tailings from the Park City region increased from 313,000 tons in 1926 to 380,434 tons in 1927. The estimated output of the district was 31,803 oz. of gold, 7,157,200 oz. of silver, 2,653,800 lb. of copper, 81,940,000 lb. of lead, and 44,964,400 lb. of zinc. There was a marked increase in the total amount of milling ore mined and in all metals recovered.

A good increase was recorded in silver and lead from Tooele County, especially from the Bullion Coalition and Stockton Lead properties, but the output from Big and Little Cottonwood districts decreased.

Exploring for Ore by Potential Methods

CONCLUDING INSTALMENT*

By E. G. LEONARDON and SHERWIN F. KELLY
Schlumberger Electrical Prospecting Methods, New York

A SCIENCE as young as geophysics does not work along the same lines as an old-established one that rests upon a large number of facts and laws already discussed, explained, and classified. It is a growing science, constantly attacking new difficulties and augmenting every day its stock of knowledge. It is hardly necessary to point out that though problems are

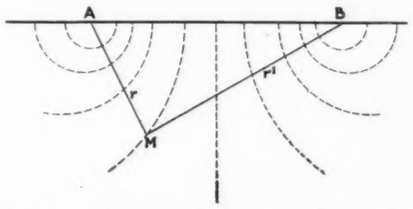


Fig. 8—A diagram illustrating the equipotential surfaces resulting from the passage of an electric current through the earth between point A and point B

encountered which are pleasant and easy to solve, some others give cause for much thought to the conscientious geophysicist. In these complicated cases, it becomes necessary to bring in converging lines of evidence, thus assuring the correctness of the interpretation. Only one way exists to accomplish this, which is to check one geophysical method by another. In this connection, the potential method which will be described hereafter must be considered not only as a second process of locating minerals, but also as a means of checking in an independent way the results obtained by the self-potential method. The basis of this method is the following:

If an electric current is caused to flow through the earth between two points A and B (Fig. 8), it does not go from A to B by the shortest route, but uses, on the contrary, all the existing volume offered for its passage. Its distribution can be mathematically calculated if the soil is homogeneous. In this special case, the formula which gives the value of the potential at any point in the soil is:

$$V = K\left(\frac{1}{r} - \frac{1}{r'}\right) \qquad (1)$$

where the letters r and r' refer to Fig. 8 and K is a constant.

The equipotential surfaces are given by the equation:

$$\frac{1}{r} - \frac{1}{r'} = \text{Constant} \qquad (2)$$

They are surfaces of revolution having the line AB as the common axis. In the neighborhood of A or B, one of the quantities, $\frac{1}{r}$ or $\frac{1}{r'}$, is very small in comparison with the other one. The equipotential surfaces, then, are essentially hemispheres, with centers A or B. In the middle of AB the equipotential surfaces are practically planes perpendicular to AB.

Equation 2 represents also the equipotential curves which may be drawn on the surface of the soil. In the case of a homogeneous and isotropic medium, these are known *a priori*. Their general form is given in Fig. 9. The value of the potential on every curve is easily found from Equation 1.

When the value of the potential is known for every equipotential curve, the variation of this quantity may be studied along a given line. This will give a "potential profile." For example, along the line AB, the potential profile in the case of an homogeneous and isotropic soil has the shape shown in Fig. 10.

If the soil is not homogeneous, but is composed of rocks of different conductivities, the electric current will not be distributed according to the same law; the equipotential surfaces, the equipotential curves, and the potential profiles will be somewhat different from the theoretical ones as described above; disturbances in the shapes will appear. The problem of electrical exploration is to locate these disturbances accurately and to interpret them

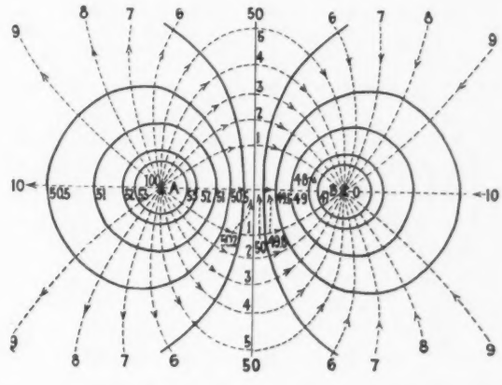


Fig. 9—Diagram showing the general theoretical form of equipotential curves in the case of an homogeneous and isotropic medium

*The first installment of this article appeared in the issue of Jan. 14.

correctly. The following elementary examples show how such interpretations are made.

Suppose a mass *Z* (Fig. 11), lies beneath the middle region of *AB*, where the equipotential surfaces are prac-

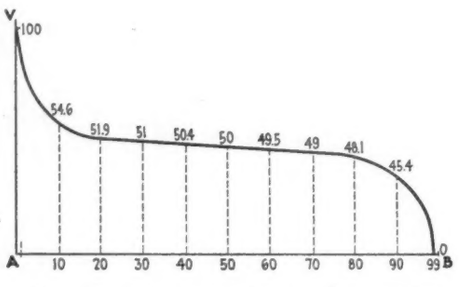


Fig. 10—The potential profile in the case of an homogeneous and isotropic soil

tically vertical planes. Were it a perfect conductor it would be at exactly the same potential throughout (since the drop in potential is proportional to the resistance encountered). Therefore an equipotential surface would not cut through it, since that implies a difference in potential between the materials on opposite sides of the surface, but would pass around it, so that the body would lie entirely on one side or the other of the given equipotential surface.

The action of conductive material is, therefore, to repulse those equipotential surfaces near it. If the same is not a perfect conductor, the resulting disturbances are less striking, but exist to a marked extent, nevertheless. Fig. 11 shows the observed results.

If, on the other hand, the buried mass is more highly resistant than the surrounding ground, the current is forced to flow around rather than through it, as shown in Fig. 12. Because the equipotential surfaces are normal to the current lines, the effect of the above-stated action is to bend the surfaces in toward the resistant mass. Looked at from a point of view more comparable with the explanation given for the conducting mass, the resistant mass will have a greater potential drop in a given distance than will the surrounding material. As a result, there must be a greater number of equipotential surfaces (representing a certain drop of potential from one to the next) cutting across that given distance. Therefore, there will be a crowding and bending in toward the resistant mass of the equipotential surfaces near it.

Thus, it is seen that, in principle, the method consists of drawing up the "map of potentials," comparing it with the theoretical form and interpreting the distortions observed thereon. In the particular case of the location of a conductive orebody, these distortions will appear in the form of repulsed equipotential curves.

It is obvious that the search for orebodies is only one favorable phase of the application of the potential methods, which are also applicable in every instance where marked variations occur in the electrical conductivities of geological formations.

Procedure as Evolved for Field Work

These explanations are given in a rather elementary way to show only the basis of the method. Evidently, in practice it is necessary to devise a technique permitting a more rapid covering of ground than can be accomplished by using the equipotential curves alone. Such a procedure has been evolved and, in fact, as a rule, the original technique of the map of potentials is scarcely used by us. The reason why this is possible will be readily seen from a study of the following considerations:

1. The potential methods are able not only to trace equipotential curves but also to measure differences of potential. These latter are not qualitative measurements but quantitative; not relative but absolute. Hence the possibility, through the rigid application of calculus, of deriving numerous geo-electric parameters from the equation of potentials (previously given in the case of an isotropic medium, Equation 1).

2. The tracing of equipotential curves is then replaced by measurements of differences of potentials along straight lines. Disturbances in the electrical field are made evident by calculations based on the field measurements, and graphically represented by parameters which are in simple relation to the conductivity of the ground. This type of work is illustrated by Fig. 13, showing the electrical characteristics obtained in the course of one of our recent explorations in this country.

The possibility, previously pointed out, of making absolute measurements is one of the advantages of the potential methods; an advantage which is not possessed by all electrical methods to the same degree or with the same ease of operation. To this, it must be added that

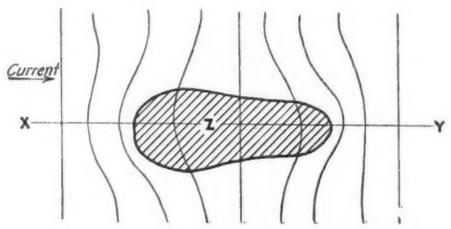


Fig. 11—Diagram illustrating the effect on the equipotential map of a highly conductive mass, Z, beneath the middle of the region AB *indicated in Fig. 9*

the study of the conductivities of geological terrains is one of the simplest theoretical problems encountered in this type of geophysical work. Moreover, from a practical point of view it can be undertaken without danger of interference from other electrical phenomena (induction, capacity[1]). This makes evident some of the qualities of the potential methods, which are:

1. Simplicity of the mathematical problem presented and of the physical properties studied.

2. Ability to measure absolute quantities upon which mathematical calculations are based.

3. Ease of correlating observations with causal facts; that is to say, ease and security in making interpretations.

Other Problems

Aside from the exploration for unknown orebodies the use of the electrical current can render appreciable service in solving many other types of problems which occur in connection with mining. In order not to make this paper unduly long, only the two following examples will be cited:

1. *Determination of the Shape of a Conductive Ore-*

[1]These electrical phenomena bring with them additional distortions of the electric or electromagnetic field which alter the precision of the observations. Such distortions are particularly unavoidable with electromagnetic methods.

body[2]—Consider an orebody made up of highly conductive ore (pyrite, chalcopyrite). Its conductivity is practically infinite in comparison with that of surrounding rocks. Suppose that this orebody is known at some point by drift or reconnaissance work. Connect with that point one terminal of the line passing the current through the ground. The entire mass of the ore will be at the same potential and its surface will be an equipotential surface. Other equipotential surfaces will be somewhat parallel to the first one. If equipotential curves are drawn above the apex of the ore they will give its general shape. Fig. 14 shows the results obtained in this way on the copper orebody of Bor (Serbia).

This kind of work finds its application in defining the importance of a mineralization (lens, vein, shoot, chimney) which is known by only a limited exposure at the surface or in workings. A few days of exploration usually suffice to decide whether or not the discovery is important, to outline its form and to orient future exploitation.

2. *Use of Structural Studies*—Structural studies, or in other words the differentiation of rocks by electrical measurements, have numerous applications, and it is not possible in this paper to take up the subject in its entirety. The following example shows how a problem concerning a search for non-metallically conductive ore has been solved.

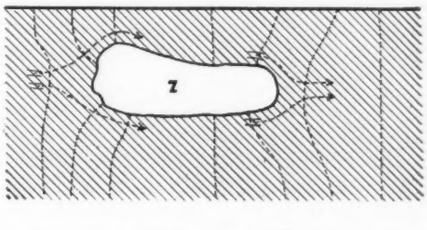


Fig. 12—If the buried mass (refer to Fig. 11) is more highly resistant than the surrounding ground, the current is forced to flow around rather than through it

This study was one of a number successfully carried out in the iron basin of Normandy (France). It was concerned with the following of an iron carbonate bed, intercalated between sandstone and shale strata, steeply tilted and covered by 200 ft. of horizontal Jurassic clays and limestones.

The problem was attacked as follows:

If a current is caused to flow in an homogeneous soil between two earth connections A and B, the equipotential surfaces in the neighborhood of A and B are approximately hemispherical. If the rocks, instead of being homogeneous, are made up of strata, the current will flow more easily in a direction parallel to the beds, where aqueous conductive fissures are present, than in one that is perpendicular thereto. There will be a longitudinal and a transverse conductivity, which will differ from each other. The equipotential surfaces will be ellipsoids of revolutions with their axes of revolution perpendicular

[2]As previously explained, the chief utilization of the potential method, in the exploration for ore, consists in locating and outlining the shape of unknown mineralizations concealed under an overburden. This is done by the study of the distortions of the potential field. If, by chance, a point of mineralization is known and accessible, the whole current can be caused to flow in the ore; in this very favorable case the distortions obtained are tremendously increased and the problem can be solved more accurately.

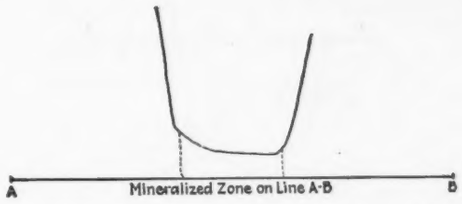


Fig. 13—Electrical characteristics obtained by measuring differences of potential along straight lines, in the course of recent exploration work. Mineralized zone on A-B *lies beneath low portion of curve, between dotted lines*

to the trend of the beds. The equipotential curves will be ellipses, the major axes of which will be coincident with the trend of the beds.

Fig. 15 shows the results obtained in this manner in Fierville-la-Campagne. The tilted Silurian beds and, consequently, the interbedded iron formation, were successfully traced for many miles. The resulting conclusions were tested by drilling and proved entirely correct.

Flexibility of the Potential Method

From the discussion of the potential method and examples given, one salient feature of this method is put in evidence: This is its great flexibility. This flexibility permits the attack on mining problems to be made through several and decidedly different channels. In addition, the scale of the electrical observations can be varied indefinitely according to the magnitude of the problem to be solved. This is done by changing the distance between the earth contacts. The entire matter is merely a question of correspondences, and observations can be successfully made to great depths, provided only that the geological phenomena being studied are sufficiently large.

Many other geophysical methods do not possess such a flexibility to the same extent and are not capable of considering a problem from such different angles. For example, gravimetric or magnetometric methods employ

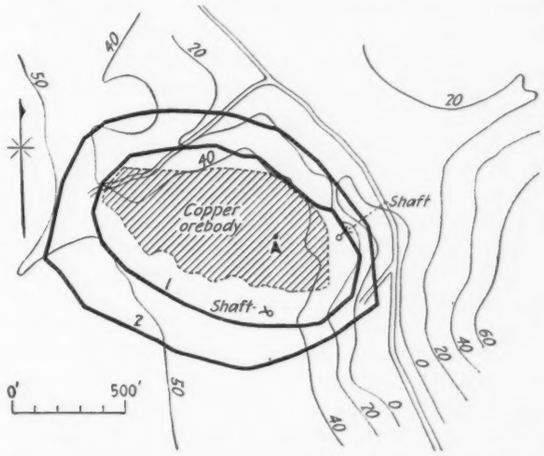


Fig. 14—Results obtained at Bor, Serbia, determining the shape of copper orebody there

very sensitive instruments, but can repeat only indefinitely the same kind of observations.

Regarding exploration for orebodies, the use of two independent electrical methods provides an additional

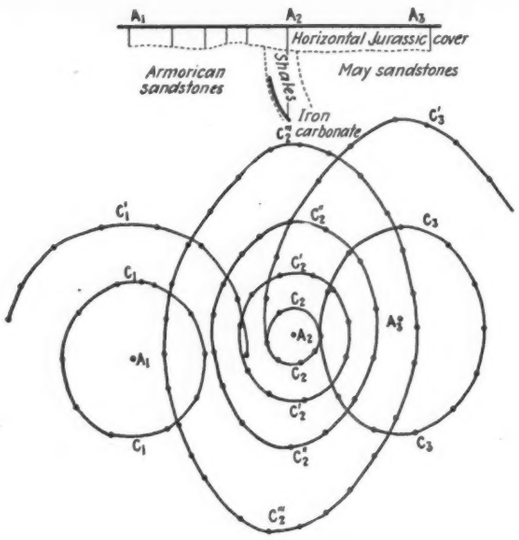


Fig. 15—Results of structural studies made with the potential method at Fierville-la-Campagne

security in the interpretation of results which cannot be overemphasized. Many problems are more puzzling and complicated than the geophysicist would wish them to be, and it is not too much to combine several lines of evidence to clear them up.

Cost of an Electrical Survey

A practical question, which is most interesting for the mining man, is, "What is the price of an electrical survey and how long does it take?"

The speed with which electrical work can be carried out will depend, of course, on the local conditions of topography, climate, and vegetation. In rolling, heavily timbered country, such as encountered in Ontario and Quebec, an average area of 1,300 acres (2 square miles) is generally covered in one month by one prospecting party. In open country this can easily be doubled. Taking, however, the figure first given as a basis, a survey will usually cost about $2.50 per acre and will rarely exceed $5. In favorable cases a cost of less than $2.50 can be attained.

These prices may seem extraordinarily low, but they can be reached only because technique and apparatus have been highly developed over a number of years in the direction of simplicity and speed of operation. Also, the ability and experience of the operators play an important rôle.

It is obvious that electrical prospecting does not supplant either the geologist or the diamond drill in exploration work, but supplements both and must be used in co-operation with them. Each has its own field of investigation, and a good mining engineer should be able to combine them so as to be able to give to his work a maximum of efficiency.

The geological study comes first. It outlines those formations favorable to ore occurrence and eliminates from further consideration those that are definitely unpromising.

An electrical survey of the favorable areas then follows, completing the geological study and outlining closely the mineralized areas.

The diamond drill, trenching, or sinking must now be used to confirm and complete the information gathered in the first two steps.

The result of such a well-ordered co-operation is to eliminate useless and costly work. In this connection, the cost of an electrical survey is so low that it should be as commonly used as the geological work or the diamond drilling. The savings effected by the elimination of useless drilling will in many operations more than repay the expenses incurred.

A difficulty encountered by the electrical prospector is to make clear to those employing him the exact kind of service he can render. Frequently this is not well appreciated even by technical men. They either expect miracles of such studies or deny their usefulness entirely. The truth lies between these two extremes, and the purpose of this paper will have been accomplished if it aids in demonstrating the practical possibilities of these new methods of exploration.

Tuberculosis Infection

IF a man or woman who is united to a matrimonial partner with open tuberculosis is below par physically, his or her chances of acquiring the infection are about one in six, according to *Science News*. This is the conclusion that Dr. Arnold Minnig, of Denver, has drawn from analysis of data from more than 5,000 tuberculosis cases observed at the Denver Municipal Tuberculosis Dispensary. Out of a total of 5,067, 1,888 cases were married or widowed. Of these, 319, or 16.8 per cent, Dr. Minnig has reported to the American Medical Association, were cases in which both consorts had active tuberculosis or one or the other died of the disease. These figures, in the opinion of the Denver physician, refute the theory held by some medical men that adult infection with tuberculosis is not possible. He points out that only eleven cases of the 319 were natives of Colorado, which has a notoriously healthful climate. Inasmuch as five of these died, the unpleasant possibility is suggested that a healthful climate may have the adverse effect of preserving its inhabitants from the immunizing contact with tubercle bacilli that is found in large cities, so that when such unimmunized individuals come in touch with the disease they succumb with startling ease. Dr. Minnig's figures were drawn from dispensary cases, which necessarily represent the lowest stratum in life. Consequently, he states that "this investigation gives us a most important lesson: the lower the standard of living, or the more unhygienic the surroundings, the better the culture medium for the tubercle bacillus." Hygiene and intelligent prophylaxis are the weapons to be used to prevent tuberculosis spreading in families in many communities and underground.

Carelessness Underground

At several mines delay in placing sollars in high raises has been noticed; also that timber hoisters occasionally fail to close the doors in timber slide compartments, according to the "News Letter" of the National Safety Council's Mining Section. These devices are ineffective if not used continuously. They are intended to protect captains, foremen, pipemen, and engineers, as well as the miners. As much chance of a man falling exists at one time as at another, if he is careless in keeping his feet and hands from slipping off ladder rungs. The Council's past record proves the necessity for maintaining these devices in good condition, the writer of the letter declares.

The Oil-Shale Industry

By Martin J. Gavin
Refinery Engineer, U. S. Bureau of Mines, San Francisco

THE year 1927 was not encouraging to those interested in the oil-shale industry. In Scotland, low prices and high costs have caused operations to be curtailed, some of the works and mines have been closed, and the Tarbrax and Dalmeny works have been dismantled. The chairman of the board of Scottish Oils, Ltd., on June 10, 1927, stated: "In the circumstances I have described it will be realized that we could have no income from our investment in the shale business." However, he called attention to the fact that the part of the industry still in operation was mining and retorting over 2,000,000 tons of shale per year. The production of shale from the state mines of Esthonia is to be curtailed. Most of the oil shale mined in Esthonia is used directly as fuel in locomotives and factories and in the manufacture of cement, although four experimental retorts are said to be producing oil on a semi-commercial scale. The oil-shale industry of France alone seems to be making encouraging progress, with the assistance of the import tax on petroleum products. In Manchuria, the South Manchurian Railway, controlled by Japanese capital, evidently is going ahead with its plans to install a commercial production plant in the Fushun district, where coal underlies the oil-shale deposit.

In the United States the continued high production of petroleum and consequent low prices have discouraged interest in oil shale. One of the largest plants in the country, in California, has been closed down for an indefinite period. A plant in Wyoming, planned to be the first unit of an installation of commercial size, started intermittent operation in October, and two small plants in Colorado have made several short runs. The experimental oil-shale plant of the U. S. Bureau of Mines at Rulison, Colo., closed down on July 1, 1927, as Congress did not provide funds for continuing operation. During the eight months it was operated about 2,200 tons of oil shale was retorted and important experimental results were obtained. The oil produced is now being studied by the Bureau of Mines and by several oil-refining companies and research laboratories.

While prices for petroleum products are maintained at the present low figure the prospects for the development of an oil-shale industry in this country are not hopeful.

Elimination of Antimony in the Refining of Arsenic Trioxide

ARSENIC trioxide is recovered principally as a by-product of the smelting of pyrite and sulphide ores of non-ferrous metals, most of which contain arsenic, says Chester L. Read, in introducing an article on the "Elimination of Antimony in the Refining of Arsenic Trioxide" in the January number of *Industrial and Engineering Chemistry*. The flue dusts usually contain from 15 to 30 per cent arsenic, largely as arsenic trioxide. "White arsenic," which is 99 per cent trioxide, is produced from this material in two stages. In the first stage the arsenical dust is roasted and the arsenic trioxide volatilizes and is condensed and collected in flues as black dust. This black dust contains from 85 to 97 per cent arsenic trioxide. White arsenic is separated from black dust in one operation, if the volatile impurities are not present in excessive amount, by sublimation in a coke- or oil-fired reverberatory furnace. The volatilized portion passes into a series of settling chambers or kitchens, where it condenses. When these kitchens become full, they are sampled and the condensates produced, containing the highest quality of arsenic trioxide, are mixed so as to obtain the largest possible yield of 99 per cent arsenic trioxide. The lower-grade material is resublimed.

The black dusts, which cannot be refined effectively in one operation, usually contain antimony, which is probably the most difficult impurity to eliminate in the refining process. About half the antimony volatilizes in the refining furnace and condenses with the arsenic trioxide. Under these conditions it is not possible to refine black dust of high antimony content in one operation and at the same time secure a high recovery of white arsenic. Under normal conditions when the antimony content of the black dust is under 1.5 per cent, about 75 per cent of the arsenic charged into the refining furnace is recovered as white arsenic. As the antimony content of the black dust increases above this figure, the yield of white arsenic is correspondingly decreased and the yield of lower-grade arsenic trioxide, which must be recharged to the refining furnace, increases.

An investigation to discover a method of treating black dust or byproducts, relatively high in antimony, to make possible a high recovery of white arsenic in one refining operation, is summarized by Mr. Read as follows:

1—In the refining of arsenic trioxide by volatilization it was not found possible to prevent the volatilization of a large portion of antimony present in the material being refined. It was possible, however, to concentrate the major portion of the volatilized antimony in a small amount of arsenic trioxide (10 to 30 per cent antimony) in that portion of the flue (condensing tube) nearest the furnace. From 70 to 80 per cent of the arsenic in the black dust was obtained as a pure arsenic trioxide further along the flue.

2—Segregation of the antimony in a small part of the arsenic trioxide was accomplished by careful control of the temperatures of the furnace and flue, and regulation of the volume of air drawn through them.

3—For the best results the temperature of the flue near the refining furnace should be about 350 deg. C., as much surface as possible should be provided for the condensation of the vitreous deposit, and the volume of air drawn through the system should be as small as possible.

4—The temperature of the furnace is apparently not so important except as it affects the temperature of the flue.

DISCUSSION

The Status of Mining

THE EDITOR:

Sir—The address delivered by Prof. Frank H. Probert, Dean of the College of Mining in the University of California, as published in the *Mining Journal* of Nov. 5, gives expression to a protest previously voiced at recent meetings of the American Institute of Mining and Metallurgical Engineers, as well as at the convention of the American Mining Congress. The protest is made to the state and federal governments in regard to the relatively inadequate financial support given to the bureaus that are devoted to the service of the mining industry, in comparison with the support accorded to the official agencies created for the benefit of agriculture. This, of course, is an old story, but it has a new meaning, and therefore is worthy of thoughtful consideration.

The State of California yields annually $450,000,000 of mineral products and $469,000,000 worth of agricultural products, yet the state legislature appropriates $3,500,000 annually for the advancement of agriculture and only $128,000 for the aid of the mining industry, so that the ratio is 37:1. In other words, the state legislature provides $1 for every $101 of the agricultural output and another dollar for every $1,622 of the mining output. The comparison is eloquent. The mineral products of the United States in 1926 had a marketable value of about six and a quarter billion dollars; the total value of the agricultural products of our country last year was twelve billion dollars. Thus the ratio is nearly 1 to 2. The number of men engaged in the mining industry is to the number engaged in agriculture as 1 to 5.7; thus one miner produces three times the wealth produced by one farmer. On the other hand, the federal appropriations for the service of agriculture are twenty-five times those set aside for mining, and as regards research specifically the funds allocated to mining are half those given to the aid of agriculture. A recent reduction of $600,000 in the appropriation for the United States Bureau of Mines drew forth a categorical protest from the American Institute and the Mining Congress at Salt Lake City on Aug. 22. Meanwhile a committee of the Institute, headed by J. V. W. Reynders, is discussing the matter with General Lord, the Director of the Budget, and in the Institute magazine for November will be found the text of a cogent statement addressed by Mr. Reynders to General Lord. The gentlemen at Washington are asked "to recognize more seriously the outstanding importance of our mineral resources in maintaining our position in world affairs, and to appreciate the fact that it is due to their wide exploitation that our great national development is to be attributed." To those familiar with the history of mining, in its national and also in its world-wide aspect, this statement awakens reverberant echoes of recollection.

It is astonishing how little the fact is realized that civilization followed on the heels of the mineral explorer. The lack of appreciation of this historic fact is remarkable in the United States, and it is even more strange in England, where mining is still regarded in official circles as a somewhat questionable enterprise associated with queer doings on the stock exchange. The expansion of the British Empire, or the British Commonwealth of Nations, was a consequence of the discovery and exploitation of mineral deposits. Australia was a convict settlement until Hargraves found gold on the Macquarie watershed in 1851. Canada did not come to maturity until its western domain was opened to productive industry by the discovery of gold on the Fraser River in 1859. The spread of British rule in southern Africa was the direct sequel to the finding of diamonds at Kimberley in 1870, of gold on the Witwatersrand in 1886, of lead and copper deposits in Northern Rhodesia in 1891. In the United States the country west of the Missouri River was a mere wilderness over which only a few fur traders roamed until the bugle call of mining adventure drew thousands of eager men to the Pacific Coast. The discovery of gold in California in 1848, of the Comstock lode in 1859, and of the silver deposits of Leadville in 1875, turned large spaces on the map into new fields of beneficent industry; the wilderness became a human habitation, the East and the West were joined with links of steel, the purchases and annexations of territory became a real national domain.

The precious metals have played a spectacular part in world economics from the day when the silver of the Laurium mines gave Athens the money to build the ships that won the battle of Salamis and turned the tide of human history. In a later day Hannibal drew the sinews of war from the Baebulo mine, near Linares, in Spain, and the Romans fought the Carthaginians for the mineral wealth of the Iberian peninsula. The discovery of America was itself the consequence of an attempt to reach the fabulous wealth of India. The *conquistadores* seized the gold and silver that gave Spain a short-lived hegemony of the so-called Christian countries, and when the heavily laden galleons were seized by the English buccaneers in the sixteenth century the treasury of the Tudors was so enriched that they no longer had to borrow money from the Flemish bankers of Antwerp. The flood of silver that came to Europe in the seventeenth century and the gold that California and Australia produced in the middle of the nineteenth century alike quickened the channels of commerce, widened the scope of geographic exploration, prompted world-wide migrations of enterprising men, and, by shifting wealth to the working class, enabled the artisan and the craftsman to emerge from the sunken strata of human society; the produce of the mines killed the feudal system and created that so-called middle class, neither privileged nor downtrodden, which is the founder of representative government and the political champion of liberal ideas.

The precious metals have played their part in economic

history, but as Solon is reported to have said to Crœsus, when the Lydian king showed him his treasure: "Sir, if any other come that hath better iron than you, he will be master of all this gold." Today the economist appreciates the truth of the Athenian philosopher's remark, even if, as we have reason to believe, he did not say it to Crœsus, because their trails never crossed. Industrial leadership, and all that goes with it, belongs to the nation that is the chief producer of iron. Under the conditions of our mechanistic civilization the part played by iron is decisive. For a century or more, England, by the early and efficient utilization of her coal resources, was the world's workshop. Her exports of coal gave her cheap return freights and enabled her not only to monopolize the carrying trade of the world but also to obtain cheaply the raw materials of a manifold manufacture. The coal seams lay near the deposits of iron ore, so that cast iron at first, and steel later, could be smelted cheaply. Until 1895 England was dominant, but by that time the United States had got into her stride and the leadership began to pass to a new industrial colossus. In the last resort the Great War was decided by the ability to produce steel and the lethal weapons needed for the obscene insanity of international murder. The statistics of 1913 are eloquent, showing, as they do, the dominating position of the United States in coal, and particularly in steel production:

	Output of Coal Tons	Output of Steel Tons
Great Britain	292,202,000	7,543,000
United States	562,595,000	31,823,000
Germany	278,627,000	19,292,000
France	42,671,000	4,419,000

Industrially, Germany could meet the combined strength of England and France, but when America entered the war she was doomed to defeat. Today our strength is greater still; we are producing 62 per cent of all the steel in the world, and 40 per cent of the coal; our reserves of the essential minerals are enormous, and if we use them wisely we shall maintain our position as the successor of England in dominating the economic world. Of the six principal raw materials of our machine-made civilization—namely, iron, coal, oil, copper, lead, and zinc—we now produce 53 per cent of the world's total output, and this is done, be it remembered, by a nation of 120,000,000 people, as against the 1,900,000,000 world inhabitants. This is a portentous fact. It remains for us to use our wealth generously, to exercise our strength helpfully, and to throw all our influence on the side of those that are working for peace among the nations of the world.

Our legislators at Washington and those that have the disposal of funds, whether state or federal, for the furtherance of industry and of the research incidental thereto, will be wise in considering the part that mining has played, and will continue to play, in the development of our country and in its accession to leadership among the nations of the world. They may be reminded that civilization started with the fixity of habitation that followed upon the development of agriculture in the valleys of the Nile and the Euphrates, but that human culture commenced with the fabrication of metallic implements whereby man was enabled not only to construct his houses, his ships, and, unfortunately, his weapons of war, but also to devise the instruments by aid of which he began to investigate the secrets of nature, and thereby turned her forces to his service. The passport of civilization is the use of metals. T. A. RICKARD.

San Francisco.

Louvain Memorial to Engineers

THE EDITOR:

Sir—The Louvain Memorial to engineers of the United States who gave their lives in the Great War has been highly commended from many quarters. To date, about 62,000 circulars have been mailed by eleven societies, with publicity in the journals of fifteen societies, other engineering journals, and the lay press. By 1,550 persons $17,500 has been subscribed in amounts from 25c. to $1,000 in the short time since the circulars were mailed. Personal letters have been written to several hundred men. Several military organizations have requested the privilege of participating. Mention is being made of the memorial at annual meetings of societies and pictures are being used. Efforts, especially of the personal sort, must be kept up, to get the fund nearer the $80,000 total needed. Out of respect to our dead and good will to our friends across the seas there should be ten times as many subscribers.

Information about many names for the honor roll continues to come. Doubtless many others who died in war service have not yet been reported.

The project has been approved by the rector of the University of Louvain, the Belgian Ambassador, President Hoover of the Commission for Relief in Belgium Educational Foundation; Mr. Whitney Warren, architect of the Louvain Library, and others in official positions. Next July 4th will be the day of dedication. Therefore, work on the clock and the carillon is already in progress. The four dials of the clock will be of special design, having 48 American stars to mark the hours, instead of numerals. The carillon will contain 48 bells and be equal to the best in the Eastern Hemisphere. Its largest bell will weigh eight tons. It has been named "The Liberty Bell of Louvain," and will be beautifully ornamented with society emblems and names and the memorial inscription:

IN MEMORY OF THE ENGINEERS, OF THE UNITED STATES OF AMERICA WHO GAVE THEIR LIVES IN THE SERVICE OF THEIR COUNTRY AND ITS ALLIES IN THE GREAT WAR 1914-1918

New York City. EDWARD DEAN ADAMS, Chairman.

* * * *

Them's Harsh Words, Ruth!

THE EDITOR:

Sir—Relative to Mr. M. J. Hopkins' comments, I have always felt that the women school teachers were the aristocracy of America, and that the college professors who, by reason of their mediocrity, are not capable of earning enough as professors dishing out their pabulum, are the jokes of higher education. The worthy professor is the one whose salary is large enough, and his desire to learn great enough, to take him in his spare time to the things which are of interest to him and which he believes will be of educational value to his students. The mediocre professor takes outside jobs as a peddler takes on side lines and then tries to absolve his conscience for neglecting his regular work and the mediocre way he does his outside work by saying it was done in the interest of accumulating knowledge and keeping abreast of the field, when all he does is routine commercial engineering, which would be humiliating to a real professor.

Every college professor who takes outside work and

makes a practice of it has an inferiority complex; he is jealous of a man who has the nerve to fight the tiger alone, but is content with deprecating his meager salary under the wings of an educational institution and furtively grabbing an occasional outside job. May I add that this fictitious Mr. Buxton, once a consulting mining engineer, certainly was a self-made man and never got his education out of a college, or he would not have used so many laudatory superlatives regarding a professor's ability who is soliciting outside work.

This is a day of specialists, and a college professor cannot be a good 2 in 1 any more than the laity. I have the deepest regard for college professors who are college professors because of their accumulated knowledge, and this world would be empty indeed were it not for their contributions to research and discovery. Such men are not nurtured by any college, but rather are the pillars of many colleges. These professors will live in the hearts of all the people by what they have contributed. The weak sisters, the mediocre, will always be babbling about their being underpaid, long hours, and hard work, like the mediocre in all other branches of endeavor.

Denver. JOSEPH P. RUTH, JR.

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A Reader Pauses to Appreciate

THE EDITOR:

Sir—I was greatly interested in the photomicrograph of diatoms featured on the cover of *E. & M. J.* for Dec. 24, 1927, and desire to express my appreciation and admiration of the rendition of such an interesting and difficult subject. It may justly be termed a masterpiece of photomicrographic art.

The actual area shown is probably less than 0.5 millimeter and appears to contain approximately 200 individual diatoms. I note that none are broken; that their distribution over the field is uniform; that there is a pleasing arrangement of large and small members; that a number of different varieties are represented; and that the details of the several species, regardless of variations in size and thickness, are sharp and well marked.

In this age of specialistic development we are likely to view remarkable achievements without pausing to analyze their full significance unless they carry a "Stop, Look, and Listen" sign to attract our attention. I wonder how many of your readers have "speeded across the track" in this instance without coming to a full stop.

Salt Lake City, Utah. R. E. HEAD,
Microscopist, Intermountain Experiment Station, U. S. Bureau of Mines.

[Acknowledgment is made to several of our readers who noticed and were good enough to draw to our attention the erroneous reference to animalculæ in the caption of the illustration in question.—EDITOR.]

* * * *

The Review Number for Reference Purposes

THE EDITOR:

Sir—We are herewith enclosing you clipping from *Mining and Scientific Press* published over ten years ago, showing the State Geologists, which is antiquated for use at this time. We might suggest that a list brought up to date would be a valuable item for reference by your readers. If it could be arranged in printing that all the names would appear on the same page it would be more ready for reference.

Philadelphia. FRANK SPENCER LEWIS,
President, Colonial Commercial Company.

[A corrected list of the State Geologists, and, doubtless, much other information of a similar character that would prove of interest and value to those of our subscribers who neglect to make use of it, is published yearly in the Annual Review number.—EDITOR.]

* * * *

Occupational Restrictions

THE EDITOR:

Sir—Replying to the inquiry of Mr. L. F. Van Hagan relating to the licensing of engineers as published under "Discussion" in your issue of Dec. 10, 1927, I wish to state that the question of licensing of engineers as well as persons engaged in other occupations has been under consideration and study by the Commonwealth Club of California for more than two years. A preliminary paper by that organization entitled "Occupational Restrictions" was published on April 19, 1927; and at present the club has a graduate student at Stanford University devoting his entire time to gathering facts relating to the subject. In California work in regard to the licensing of engineers was made possible through the pocket vetoing of a bill to license engineers by a former Governor of the state, thus giving time for study.

San Francisco. WALTER STALDER.

* * * *

Color of the Rio Tinto

THE EDITOR:

Sir—Referring to a letter to the editor on the color of the Rio Tinto in your issue of Aug. 20, 1927, Dr. H. C. Boydell has called my attention to an oversight in omitting the exponents in the equilibrium expression for the hydrolysis of ferric sulphate. The equation should have read:

$$\frac{C_{Fe_2(SO_4)_3} \times C^6_{H_2O}}{C^3_{H_2SO_4}} = k$$

This, no doubt, is a trifling matter, but geology would gain greatly if its expounders were invariably held accountable for the loose thinking and careless statement in all that concerns physics, from which the literature is not altogether free. H. H. KNOX.

London.

* * * *

Flotation Nomenclature

THE EDITOR:

Sir—In response to the invitation in your issue of Dec. 3, in regard to flotation nomenclature, I suggest:

(1) Straight Flotation, in the case of a single metal-concentrate;

(2) Collective Flotation, in the case of two or more metals in the same concentrate;

(3) Selective Flotation, when one metal, among two or more, is concentrated;

(4) Successive Flotation, when two or more metals are floated separately to form distinctive concentrates.

Such terms as collective-selective or collective-successive would, I believe, cover all special cases in practice. "Differential flotation" I find confusing.

Athens, Greece. H. VASSILIADI.

INDUSTRIAL PROGRESS

Welding and Cutting—A Modern Way of Saving Money

"YOU believe that there is a better way of cutting metals than by saws and chisels and a better way of fastening them together than by bolts and rivets," said a speaker to an audience of welding men in Chicago recently. He had in mind the welding and cutting torch.

The use of welding and cutting, both with the oxyacetylene torch and with the electric current, has increased enormously. Today it is standard practice in the plants of the United States. Here and there are shops that for various reasons stick to the old-fashioned ways, but these are steadily becoming scarcer, so far as welding is concerned. As savers of labor and time the torch and the electrode have won for themselves a unique position among the various tools used in shop work.

Application of these useful tools in the mining industry has been wider and more general than is perhaps known. Especially in making quick repairs on heavy machinery have they proved their value. One operator, in Utah, expresses the opinion that these torches have resulted in a greater saving of labor than any other single apparatus. At the large property under his management both electric and acetylene apparatus is used. He states that the company employs the electric arc in the following ways:

Building up worn bearing surfaces on shafting varying in size from 2⅞-in. diameter, used on vibratory screens, to roll shafts up to 15 in. in diameter. This results in a great saving of shafting which formerly had to be scrapped, he claims.

Building up cheek plates on rolls of various sizes, so that they are as good as new, at a cost of $1.50 to $2, whereas formerly new castings were required at a cost of $16 to $20.

Building up miscellaneous castings, subject to wear, in similar fashion.

Welding steel tanks of all sizes, which formerly required riveting. The welding not only makes a better job but is also much neater and less expensive.

The acetylene torch is used at the same mine for the following purposes:

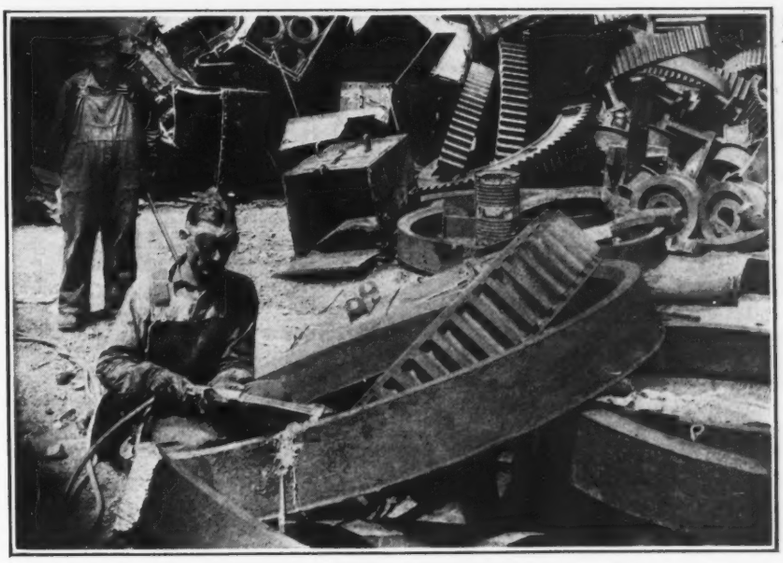
Cutting railroad rail and other miscellaneous steel to foundry cupola size.

Cutting off old shafting, from which forgings are made, which formerly required heating of the shafting and cutting under the steam hammer; also for cutting off old roll shells, and for cutting steel plate to any desired shape.

Welding broken pulley arms; building up steel piping to any desired shape; welding up steel tanks, all sizes; and for heating various shapes for any desired bending.

Welding various pieces together to make parts for machinery, which formerly required expensive forgings.

Welding handles, arms, and lugs to various objects, which formerly required drilling and tapping or riveting.



The torch does what would otherwise be impossible
Cutting up scrap in Butte

In structural steel work the torch has resulted in a great saving of labor in burning out rivets, in burning holes for rivets and bolts, in cutting steel on the job and in miscellaneous welding.

At a Southwestern Plant

At an important copper smelter, in the Southwest, a large amount of welding, cutting, and resurfacing of metals is done with both the oxyacetylene torch and the electric arc. The operations are too numerous to tabulate here. The oxyacetylene equipment at this plant consists of 14 welding torches and 35 cutting torches (600 men are on the payroll). The electric welding equipment consists of three portable single-operator sets ranging from 175 to 225 amp. and one semi-portable set for one to three operators at a total capacity of 500 amp., making a grand total of 1,100 amp. for the use of a maximum of six operators. One rheostat set is also used.

The same company at its mine (open pit and underground) is using for track bonding one 250-volt, direct-current welding machine, equipped with resistance which cuts the voltage on the arc to approximately 30 volts. With this machine, one man can make approximately 40 bonds daily, it is stated, taking current from the overhead trolley. All bonding on the tracks in this mine is handled by this machine at present. In addition, the company has one constant-potential, motor-generator set for electric welding. Approximately one and one-half welders are engaged in electric welding and one-half on torch work. Practically all of the cutting in the shops, with the exception of the work which requires even edges, is done with the torch. Underground, owing to the large amount of material used in the shaft pockets, grizzlies, stations, and other parts of the mine workings, it is necessary to use a torch exclusively. The steam-shovel department keeps one welder engaged either on cutting work with the torch or electric welding.

In the Iron Country

Oxyacetylene welding and cutting equipment is employed at practically all of the mines of a certain iron-ore operator. In all, 110 such equipments are in use. The storage of carbide, acety-

lene, and oxygen required is taken care of by special warehouses provided exclusively for this purpose. These warehouses range in size from 80 sq.ft. of floor space in one district to 900 sq.ft. in another. This operator finds that welding has its greatest use in the open-pit mines on the Mesabi range, where the work consists of welding locomotive frames, steam and electric shovel castings, tank work, car parts, and miscellaneous structural steel; also, cutting blacksmith shop stock, wear plates, and scrap, and burning holes in miscellaneous plates, and the like. In 1926 this company used 534,000 cu.ft. of compressed acetylene and 28 tons of carbide for cutting and welding purposes.

Still another operator, in the Pacific Northwest, uses welding and cutting torches, both electric and gas, extensively in all departments, particularly at its smelter, where, in addition to other applications, the torches are used around the furnaces on excretions. In the boiler and machine shop, daily use is made of such appliances. Furthermore, oxyacetylene torches are employed for lead burning in the refinery and also largely in certain construction work that is under way.

Electric-arc cutting is used extensively for taking apart old structures and equipment by another large mining company, which has found that thus it saves considerable money as compared with hand cutting. This company makes extensive use of both electric and acetylene-gas equipment.

A company that has many plants in North America declares that it has no operation of any size that is not using either electric welding or acetylene torches for cutting and fabricating. It even goes so far as to employ the acetylene torch to clear tap holes in its furnaces.

One operator, small in comparison with the others already referred to, has been using a novel acetylene torch outfit for mine and mill work for the last five years. It is mounted on a Ford truck and is moved from one mine to another, and is almost constantly in use cutting and welding, principally in welding pipe lines.

Numerous other operations, large and small, where welding and cutting are extensively practiced, might be cited. Many superintendents say, "We do not see how we could get along without it." Nor could they, any more than they could get along without the automobile and other modern inventions to which they have become accustomed.

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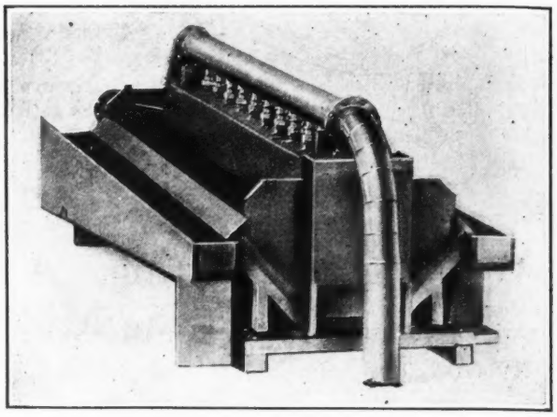
Engineering Firms Merge

The merger, under the name of United Engineers and Constructors, Inc., of four important engineering contracting organizations has been announced. The companies are: Dwight P. Robinson & Company, Inc., New York; U.G.I. Contracting Company, Philadelphia; Public Service Production Company, Newark, N. J.; and Day & Zimmermann Engineering & Construction Company, Philadelphia.



Positive circulation, low power and upkeep costs, and high efficiency are among the advantages claimed for this air-lift type flotation machine

A New Flotation Machine

AN AIR-LIFT type flotation machine has been developed by the Southwestern Engineering Corporation, of Los Angeles, following more than a year of experimental and research work, according to a recent announcement. This machine has had practical application in many mining districts, treating gold, silver-lead, zinc, and copper ores. In the opinion of the manufacturers, it has been developed to a high point of efficiency. Difficulties as to porous medium have been avoided, it is said. The machine is characterized by its extremely low power and upkeep costs. The double spitz type has a capacity of from 3 to 10 tons per 24 hours for each lineal foot of machine. In this type of device the circulation is exceptionally positive, it is asserted, and no incrustations detrimental to the flotation circuit can form in any way.

The company has recently opened a branch office at 426 Transportation Building, Montreal, Quebec.

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Hammer Drill Improved

New features are embodied in the Model 40 rock hammer of the Cochise Rock Drill Manufacturing Company. This drill differs from the ordinary hammer machine in that the air hose is connected to a gooseneck swivel, giving more flexibility and saving the hose from kinks and short bends. The machine thus equipped takes less space laterally, an advantage in drifting. Moreover, the throttle valve is located in a fixed position where it is not exposed to injury and where it can be operated easily.

The new model is made in both wet and dry types, unmounted (weighing 51 lb.) and mounted (100 lb.). In the dry type, air is used for ejecting the cuttings. The wet type has a water tube, water being used to keep down the dust and eject the cuttings. A hole-cleaning device is provided, making it easy to drill deep holes.

Automatic oiling is employed, the reservoir being located in the handle grip. Ratchet parts are of forged steel, hardened. The hammer is also of superior lasting quality.

BULLETINS

COKE—The KSG process for low-temperature carbonization of coal is described in Catalog KSG-2 of the International Coal Carbonization Company, 200 Madison Ave., New York. The process takes its name from the initials of the Kohlenscheidungs-Gesellschaft, literally Coal Separation Company, which was organized for its development.

GENERATORS — Allis-Chalmers Manufacturing Company, Milwaukee. Bulletin 1142, entitled "Engine Type Direct Current Machines." Twelve pages.

SUBSTATIONS—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Circular 1785, on "Automatic Mining Substation." Twenty pages, and several inserts.

CRUSHERS — The automatic apron crusher and pulverizer is described briefly in a bulletin issued by the A-A Crusher & Pulverizer Company, Inc., 136 Liberty St., New York.

EXPLOSIVES — The du Pont company has issued a bulletin tabulating the various brands of explosives that it produces and the uses to which they are adapted. The purpose is to aid the consumer in avoiding the purchase of unsuitable explosives and in selecting those that will give the best results in proportion to cost.

RAILROADS—Worthington Pump and Machinery Corporation, New York. Bulletin WP-1000 covering pumps, air compressors, steam condensers, engines, and accessories for railroads.

REFRACTORIES — Denver Fire Clay Company, Denver. Bulletin 140, "Facts About Refractories." Pages 30.

WEAR-RESISTING METAL — "Strenes" metal for chutes and liners is described in a 24-page pamphlet issued by the Advance Foundry Company, Dayton, Ohio. This metal is a very hard, long-grained mottled iron, alloyed with nickel and chromium. The company claims that it will withstand severest wear and abrasion and remain proof against warping or distortion when subjected to severe heat.

VALVES—Homestead Valve Manufacturing Company, Homestead, Pa. A bulletin on valves, in particular about the Homestead Ross shut-off valve.

NEWS OF THE WEEK

Summary

COMPLETION of an aërial map of the Oklahoma section of the Tri-State zinc-lead district is announced by the U. S. Department of the Interior.

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Wigwam Mining Company of Tacoma, Wash., develops more than two million tons of ore on its property in the Revelstoke district of British Columbia.

* * *

Tonopah production increases in December compared with November, but at close of year conditions in the district are generally less favorable than a year ago.

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Inland Steel Company obtains an option from the Keweenaw Land Association to explore the Indiana property on the Menominee range in Michigan.

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Ford Motor Company erects a unique surface plant at its Blueberry mine on the Marquette range in the Lake Superior district of Michigan.

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United Verde Copper Company takes an option on the Sullivan property in the Congress district of Yavapai County, Ariz.

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Proposal to control the world output of lead is publicly mentioned at a recent meeting in London of the Sulphide Corporation, Ltd.

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Public interest in Quebec mining stocks lessens and prices show a considerable decline on the mining exchanges.

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Discovery of a platinum-bearing area of 40 square miles in extent is reported in Sierra Leone.

Senate Committee Refuses to Approve Oddie Amendment

Measure to Provide $275,000 Additional Appropriations for Mining Experiment Stations Doomed in Present Session of Congress

By Paul Wooton
Special Washington Correspondent

REFUSAL of the Senate Committee on Appropriations to approve the Oddie amendment calling for $275,000 additional appropriations for mining experiment stations sealed the doom of the effort, at this session, to secure an important increase in the work done by the federal government on behalf of the mining industry. That the Appropriations Committee should have dismissed this proposal summarily, after the Committee on Mines and Mining had voted unanimously in favor of the authorization, came as a surprise.

Though there are various specific purposes for which Senator Oddie has been urging increased appropriations, he reached the conclusion that for this year's legislation it would be more practical to concentrate on the one item of increasing the funds available to the experiment stations. It was his idea that in this way the benefits of the appropriation would have been extended to the mining industry generally.

With the funds which were proposed, it was the plan to increase by $25,000 the annual allotment at each of the seven Foster stations. In addition, it was planned to Fosterize the station at Reno and the one at Berkeley. Senator Oddie presented to the Appropriations Committee a statement showing the work now in progress at the various stations, together with a brief explanation of each problem. The following list of the sub-headings of the summary indicates clearly that the work now under way is of broad application to the entire industry:

Reduction of metal oxides; reduction of cuprous oxides; specific heat of oxides and sulphides; heats of formation of oxides and sulphides; reaction between magnetite and ferrous sulphide; the reaction between ferrous sulphide and sulphur dioxide; capillarity in leaching cupriferous material; diffusion as a factor in copper leaching; oxidation and reduction of iron solutions in heap leaching; leaching of agglomerated finely divided material; chemical methods of mineralogical analysis of copper ore and products; drilling and blasting drift rounds; beneficiation of low-grade bauxite; beneficiation of low-grade phosphate ores; coal-washing problems; separation of manganese, iron, and phosphorus in spiegel; resistance offered to flow of gas by columns of irregular solids in blast furnaces; kinetics of iron ore reduction; desulphurizing blast furnace slags; plant observations on reactions in blast furnaces; metallurgical limestone; mining and milling of mica; wire saw in slate quarrying; concentration and treatment of potash ores; utilization of greensand; effect of anhydrite in cement retardation; precious-metal loss in milling practice; cyanide recovery of precious metals associated with minor copper values; metallurgy of chromium; recovery of radium now wasted; centrifugal concentration; hydrometallurgy of manganese; oil-bleaching clays; concentration of fluorspar ores; milling of lead ores; milling practice in Tri-State zinc district; treatment of lead carbonate ores; lead-zinc sulphide separation; flotation of sulphides of copper; flotation of oxidized copper minerals; effect of slime in the separation of lead, zinc and iron sulphide; maximum solubility of zinc; briquetting of sub-bituminous coals; efficiency of heating kilns.

The foregoing is intended to be only a partial list of the experimental work now in progress. If the additional money is secured, it will be possible to more than double the amount of work done, as there will be little increase in the overhead expenses.

The Senate, however, restored the item appropriating for the government fuel yard in Washington, which had been eliminated from the bill through a point of order made in the House by Representative Blanton, of Texas. All of the government buildings in Washington and for a radius of 20 miles from the Capitol are supplied with fuel from this fuel yard.

Tonopah Production Increases in December

District Conditions More Unfavorable Than a Year Ago—Copper Basin District Improves

PRODUCTION from the Tonopah (Nev.) district for December last was slightly higher than for November. Bullion shipments totaled $143,700 in value, compared to $130,000 for November.

Tonopah Mining Company shipped bullion valued at $97,000 and shipments by Tonopah Extension totaled $46,700. The company's bullion represents production from its own mine, that of the Tonopah Belmont Development Company, that of the West End Consolidated Mining Company, and some miscellaneous leaser production from the Tonopah Divide district.

At the close of 1927 conditions in Tonopah were rather more unfavorable than a year ago. The Tonopah Mining Company, which operates the oldest and most productive property in the Tonopah district, reports plenty of ore available in its mine, with an assured production for an indefinite time. Tonopah Belmont Development Company reports recent new discoveries which may prove of some importance; most of the ore found in this property during the last few years has been first opened by means of drill holes up to 300 ft. in length, which method of prospecting is particularly adaptable to this mine on account of the many productive veins and the numerous small faults. Tonopah Extension is still milling 200 tons of ore a day, and is concentrating on development work on the 1,540 and 1,880 levels. On the latter a crosscut is being driven westerly to open up the downward extension of the oreshoots which have been mined above the 1,540 level, and which have produced the major portion of the ore tonnage during the past year. In the West End mine most of the work now being conducted is by leasers, working under a partnership arrangement with the company; 1,000 tons of ore was shipped from the mine during December. Some minor development work, mostly by lessees, has been accomplished in the Rescue-Eula, the North Star, and Montana Tonopah mines, with some production being made in the course of the operations. Except for the developments in the property of the Tonopah Mining Company, no discoveries of importance have been made during the last year.

Leasers in the Copper Basin district, near Battle Mountain, Nev., have been quite successful during the last few months, and a substantial tonnage of high-grade copper ore has been shipped to the Mason Valley smelter at Wabuska. At present about 25 tons a day of this ore is being mined and shipped. The ore occurs in sedimentary formation, and previous development work, principally as crosscut tunnels, had disclosed small veins of this copper, most of which were regarded as too small to justify further development. Leasers have drifted on these stringers, and in many instances the ore has widened and made commercial bodies up to several feet in width. There is every indication that if the present leasing system is continued Copper Basin will become an important producer of high-grade copper ore. Values are almost entirely in copper, the gold and silver content being negligible.

Aërial Map Completed of Lead-Zinc District

THE Department of the Interior announces the completion of an aërial photographic map of the lead and zinc district of the Quapaw Indian reservation, in northeastern Oklahoma. The map was made in co-operation with the War Department and the Chamber of Commerce of Picher, Okla., primarily for the use of the superintendent of the Quapaw Agency and the district mining supervisor of the U. S. Geological Survey stationed at Miami, Okla., in the supervision of mining and related operations on restricted Indian lands. It shows the location of many of the drill holes used in prospecting, the areas covered by the chat piles, and the mills, mines, buildings, streets, railroads, highways, and streams. On account of the exceptionally large number of drill holes and the proximity of the chat piles to the towns and buildings, the map will be of special value for consultation by those interested in mining in northeastern Oklahoma. The map is available for inspection and use at the Geological Survey offices at Washington, D. C., and Miami, Okla., but copies in whole or in part cannot be furnished, and reproduction for other than official use will not be permitted.

Lindbergh's Arrival at Butte Evidently Auspicious

Butte, Mont., mining operators, headed by John A. Roos, mining engineer, have been operating a property 3 miles south of Butte on the road to Little Basin Creek and about a mile east of the Ardsley Butte property. The company is known as the Lindy-Butte Mining Company, being named in honor of Colonel Charles A. Lindbergh, who arrived in Butte on the day that ore was first encountered at a depth of 17 feet on the company's holdings.

The property controlled consists of four claims, is equipped with steam machinery, and the shaft is now down about 85 ft. A drift is being run east on the 75 level to tap the gold-silver-lead ore found in the shaft.

New Work Started on Michigan Iron Ranges

Inland Steel to Explore Indiana Mine—Contract Awarded for Drilling in Chapin Workings

THE Inland Steel Company has obtained from the Keweenaw Land Association an option to explore the Indiana mine property, on the Menominee, Mich., iron ore range. Diamond drilling will be started at once by the S. E. Atkins Company, of Duluth, under the supervision of the general mine office of the Inland company at Crosby, Minn. The Indiana was last worked in 1918 by the Thomas Furnace Company. The ores produced were siliceous and low in grade, but just prior to the suspension of operations, some high grade was encountered. It is to test out further the ground where the high grade ore was encountered that the Inland company has taken an option.

A contract has been awarded to the S. E. Atkins Company, of Duluth, to put down eleven diamond drill holes from the bottom level of the Chapin mine, on the Menominee range. Total footage will be about 10,500. The work was ordered done by the fee owners, who are the Keweenaw Land Association, the Chapin Estate, and Merryman and Hamilton. Known reserves of the mine are nearly exhausted, and it is hoped to develop new ore measures at depth. The Chapin has been one of the greatest of the underground producers of the Lake Superior region. It is operated by the Oliver Iron Mining Company.

The M. A. Hanna Company has suspended operations at the Carpenter and Monongahela mines on the Menominee iron range. Reserves at the Carpenter were lowered to such a degree that the mine could not be operated at a profit. The Monongahela has an ample supply of ore, but it runs high in phosphorus and some of it carries an excess of sulphur.

A new shaft was this week started at the Penn mine, also in the Menominee range. This will take the place of two old shafts that are to be abandoned. The mine is operated by Pickands, Mather & Company.

To Sink Another Shaft at Errington Mine

At the Errington mine, in the Sudbury district of Ontario, owned by the Treadwell-Yukon Company, preparations are being made to sink a new shaft two miles east of the present No. 2. Sinking equipment will be installed as quickly as possible and the shaft sunk to a depth of about 500 ft. The No. 2 shaft is down 625 ft., at which point an ore pocket will be cut; a new level will be opened at 500 ft. No. 1 and No. 2 shafts are being connected at the 300 level, and another month's work will be necessary before this connection is made. Two raises have been run from the 300 level to the surface.

Arizona Events Include New Option to United Verde

Property Situated in Congress District —Sunnyside Company Purchases Telluride Mill

THE United Verde Copper Company has taken an option on the property owned by D. J. Sullivan, in the Congress district of Yavapai County, Ariz. The vein in this property lies in the footwall of the main vein of the Congress mine, and is said to be similar in many respects to that famous old producer. This property was developed many years ago through an 800-ft. shaft, and has produced about 100,000 tons of ore. It is the intention of the United Verde to unwater the old workings, to sample the property thoroughly and, if indications warrant, to continue development with the view of putting it on a producing basis. In the Oatman district, the company for the present has discontinued work on the drift from the bottom of the 500-ft. shaft of the Lucky Boy mine. Some diamond drilling will be done from the surface to locate the vein, after which drifting on the 500 level will most probably be resumed.

Sunnyside, of Oatman, has purchased the Telluride mill, and will either build a tramway to carry the Sunnyside ore to the mill or move the mill to its own property. The winze being sunk on the Sunnyside 535 level is now down 50 ft., and the vein has widened to 4 ft. It is reported that the winze will be carried to a depth of at least 100 ft. before drifting is started.

The 125-ton mill at the Kaaba mine in the northeast foothills of the Wallapai mountains, which began operations the first of the year on one shift, is to be placed on a 24-hour basis. Two shifts are being operated in the mine, and ore is being produced from the 250 and 275 levels as well as from the bottom of the shaft. The shaft is being extended and is now at a depth of 800 feet.

Foundations for a new 35-ton concentrator are being laid at Sahuarita, Ariz., by the Minerals and Metals Corporation. The mill, which will be of all-steel construction, has been designed to treat the complex lead-zinc ores of the district by selective flotation. It has been assembled in Los Angeles and will be shipped as soon as the foundations are completed. The site is on ground which the company has leased from the Southern Pacific Railway and lies on the right-of-way. The Twin Buttes railroad has its terminal at Sahuarita, and the town is also on the Tucson-Nogales highway, so that the mill will be conveniently situated, for mines which ship by truck or those which are near either of the railroads. According to report the new mill will be operated as a custom plant, besides taking care of the production from the Ridley mine which the Minerals and Metals company has taken over. The latter property is located in the Helvetia district, 10 miles from Sahuarita. At present a new headframe is being installed at the mine and preparations are being made to deepen the shaft. Floyd Fisher is president of the company and F. Lincoln Dean secretary-treasurer.

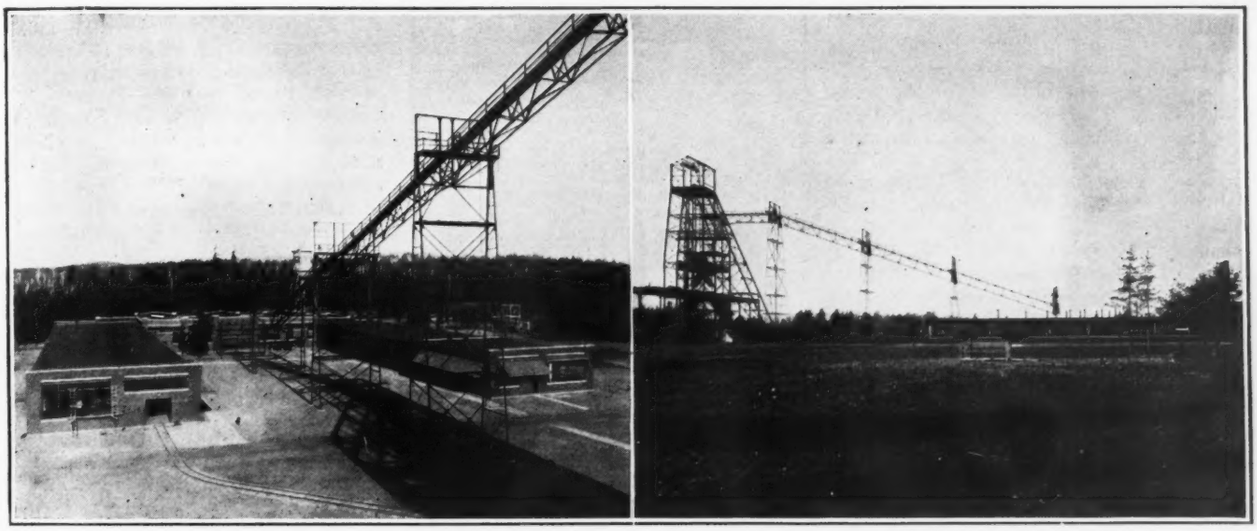
Platinum Discovered in Sierra Leone

The British Colonial Office announces that a platinum-bearing area of about 40 square miles in extent has been found in Sierra Leone, according to *Chemistry and Industry*. An analysis made by the Imperial Institute shows that the platinum compares favorably in composition with platinum from the Urals and from South Africa.

Blueberry Mine Plant Unique on Marquette Range

All Surface Departments in Single Building—Steel Headframe of Massive Construction

A UNIQUE mining plant in the Lake Superior district is that at the Ford Motor Company's Blueberry mine, on the Marquette Range, Mich., two views of which are shown in the accompanying illustrations. All the surface departments, including offices, laboratory, first-aid room, two change rooms, shower bath room, hoist room, shops, garage, and warehouse, are housed under one roof in a modern brick and concrete building. This structure is "U" shaped, the wings measuring 220x40 ft. and the portion between the wings 215x50 ft. The boiler plant is used merely for heating purposes, all the equipment on the property being electrically driven by power received from the Cliffs Light & Power Company.



Single unit housing various surface departments *Steel headframe and shieve stands*

The Blueberry mine on the Marquette range

The steel headframe, including the shieve stands, is one of the most massive in the Lake country, and was made at the Ford plants in Detroit. Numerous gravel drives and concrete walks have been laid out in the surrounding grounds, which are parked.

Shaft sinking at the property, started about a year ago, was discontinued when the shaft had been concreted into the ledge, 80 ft. from the surface. Sinking operations were resumed, however, after the permanent hoisting equipment had been installed, and a depth of 370 ft. has been reached. The shaft below the 80 ft. point is constructed of steel sets; it has five compartments—two skip roads, a cage road, a pipe compartment, and a ladderway.

Recently, a spur track to the stocking ground was built on the property. Operations on a production basis, according to recent reports, will most probably begin in the spring.

Output of Washington Mines Decreases in 1927

Value of Gold, Silver, Copper Lead, and Zinc Is $872,200 Compared With $931,491 in 1926

THE value of the gold, silver, copper, lead, and zinc produced from ore mined in the State of Washington in 1927 was about $872,200, compared with $931,491 in 1926, according to the U. S. Bureau of Mines. There was a marked increase in the quantity of gold and a slight increase in copper and zinc. These increases, however, were exceeded by the decrease in the output of lead and the general decrease in the metal prices of silver, copper, lead, and zinc.

Production of gold was more than doubled, and increased from $193,092 in 1926 to $396,900 in 1927, as a result of renewed activity both at Republic and in Whatcom County. The output of the Republic district, which produced nearly all the gold, increased from $156,765 in 1926 to $312,413 in 1927. The Quilp mine was the largest gold producer, followed closely by the Last Chance mine of the Lone Pine-Surprise Consolidated Mining Company. Several thousand tons of gold ore was also shipped from the Insurgent mine, under lease; the Mountain Lion mine; and the group operated by the Northport Smelting & Refining Company. The Boundary Red Mountain Mining Company, south of Sardis, B. C., resumed milling operations and made a large production of gold, but the Kittitas dredge at Liberty was idle.

Output of silver in the state decreased from 171,649 oz. in 1926 to 158,000 oz. in 1927. The Republic district produced most of the silver, chiefly from the Last Chance and Quilp mines. Other small producers of silver were the Sunset mine, near Index, from copper ore; the Chewelah Union group, including the Amazon mine at Chewelah, from rich silver-copper ore; and the Pend Oreille Lead & Zinc Company at Metaline Falls, from lead-zinc ore. Only one car of silver-lead ore was shipped from the Old Dominion mine, near Colville.

Output of copper increased slightly from 1,351,890 lb. in 1926 to 1,655,000 lb. in 1927. The Sunset Copper Company, near Index, ran its mill regularly and increased shipments of copper concentrate. Several hundred tons of copper ore containing much silver was shipped by the Chewelah Union Mining Company at Chewelah. As in the past, custom ore was treated at the copper smelter and refinery at Tacoma, Wash.

The output of lead decreased from 4,546,228 lb., valued at $363,698, in 1926 to 1,211,000 lb., valued at $81,985, in 1927. The Gladstone mine, near Northport in Stevens County, a large producer of lead in 1926, made no shipments in 1927 until October, but paid regular dividends amounting to $39,657 in the first half of the year. Other producers of lead were the Electric Point, near Northport; the Pend Oreille and Grand View mines, at Metaline Falls; and the Boundary and Lead Trust properties at Northport.

Production of zinc recovered chiefly from concentrate increased from 1,044,354 lb. in 1926 to about 1,410,000 lb. in 1927. The output of the Black Rock mine, near Northport, was comparatively small, but shipments of zinc concentrate with some lead concentrate were made regularly after June 1 by the Pend Oreille Lead & Zinc Company at Metaline Falls. Several lots of crude zinc ore came from the Great Western mine, near Northport.

Moulton-Anaconda Decision Is Affirmed

THE U. S. Circuit Court of Appeals in San Francisco affirmed on Jan. 9 the decision of the Butte, Mont., court given to the Anaconda Copper Mining Company in a suit involving the Badger mine and the Poser claim of the Moulton Mining Company, belonging to the Clark interests. Non-existence of the Poser vein was affirmed, but the decision of the trial judge was amended to give the Moulton Mining Company extralateral rights to the "view" vein from the west end line of the Poser claim to a point where the Emily vein crosses the south end line of the Poser claim.

W. E. Colby appeared for the Clark interests and L. O. Evans and D. M. Kelly, of Butte, for the Anaconda company. Judges Hunt, Rudkin, and Deidrich, all experienced in mining cases, heard the arguments. Costs of the suit were divided equally by the Anaconda and Moulton companies.

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Quartz Mountain Properties in New Consolidation

A deal has been completed whereby the San Rafael, the Calico, and the Quartz Mountain Metals properties in the Quartz Mountain district, Nye County, Nev., will be consolidated and operations financed by Thomas F. Cole, of New York, and associates, among whom is numbered Charles M. Schwab. The San Rafael and the Calico are controlled by the George Wingfield interests and the Quartz Mountain Metals by Mr. Cole and associates. Plans of development include the installation of a mill. In the Quartz Mountain Metals mine, a body of mill ore was recently developed, and the Calico has a shaft down 400 ft. Under the terms of the arrangement, $25,000 is to be advanced by Cole and associates for the payment of outstanding indebtedness, and $50,000 for development. During the year 1927, and beginning with April 1, the San Rafael mine shipped a total of 190 carloads of ore. Shipments will be continued, according to current reports.

Production of Oregon Mines Increases in 1927

Value of Gold, Silver, Copper, and Lead Output Advances 9 Per Cent Compared With 1926

THE value of gold, silver, copper, and lead produced in Oregon in 1927, according to the U. S. Bureau of Mines, was $365,000, an increase of $30,260, or 9 per cent, compared with the value of metals produced in 1926. The largest increase—58 per cent—was in the value of copper produced. Gold increased 3 per cent, but the value of silver decreased 3 per cent, owing to the lower price of the metal, and the value of lead decreased 68 per cent, owing to smaller production and lower price.

Gold production of Oregon in 1927 is estimated at 13,600 oz., valued at $281,000, an increase of 357 oz. compared with 1926. The Empire dredge, Superior dredge, and Buffalo Monitor lode mine were the largest producers of gold. An abundant supply of water made possible more widespread and larger placer activity throughout the state.

Output of silver from Oregon mines in 1927 is estimated at 31,700 oz., valued at $18,000, compared with 29,733 oz., valued at $18,553, in 1926, an increase of 7 per cent in quantity compared with 1926. Gold concentrates produced in Grant County yielded the largest quantity of silver, and copper concentrates were the second most important source of the metal in 1927.

The yield of copper in Oregon in 1927 is estimated at 505,000 lb., valued at $65,700, compared with 296,454 lb., valued at $41,504, in 1926. This represents an increase of 70 per cent in quantity. Most of the copper output was from the Homestead Iron Dyke mine, in Baker County.

It is estimated that 5,000 lb. of lead, valued at $300, was recovered from Oregon ores in 1927, a decrease of 57 per cent in quantity compared with 11,549 lb., valued at $924, produced in 1926. The 1927 output of lead was a byproduct of gold concentrates produced in Grant County.

In eastern Oregon the principal production of gold and silver was made by the Empire dredge, near John Day; the Superior dredge, near Bridgeport—both of which were in operation all year; the Buffalo-Monitor lode nine, at Granite, and the Ben Harrison and Rabbit mines, in the Greenhorn district. The Badger and Little Badger mines, at Susanville, and the Miller Mountain mine, near Canyon City, were also productive.

Apparently, no large-scale mining operations were conducted in southwest Oregon in 1927, but gold and silver production was larger than in 1926, as a result of the abundance of water, which permitted more widespread placer work, and owing to the finding of several rich pockets. The Progressive Mining Company, near Galice, was the largest producer of gold in the region.

B. C. Silver Mines Considers Premier Offer

Consolidated M. & S. Company Awards Gifts and Bonuses—C. C. Bush Acquires Arctic Group

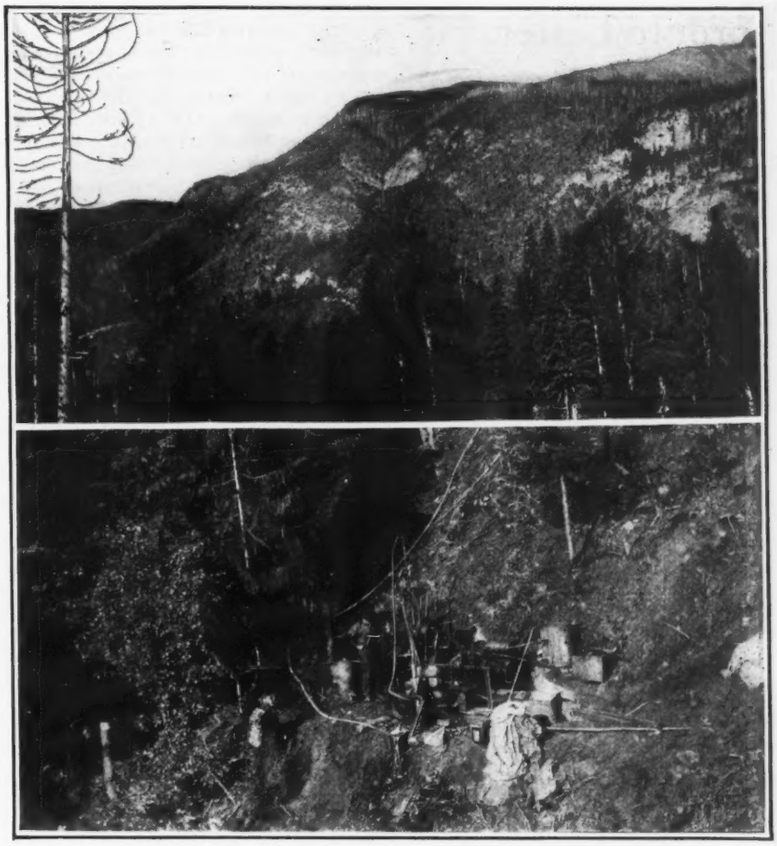
AT THE annual general meeting of B. C. Silver Mines, Ltd., held recently at the company's office, in Vancouver, Charles A. Banks, the president of the company, stated that last July the Premier Gold Mining Company examined and sampled the property and recently it had made a proposal, offering to operate the property through the Premier mine and to mill the ore at cost, plus an overhead charge per ton for the use of the Premier mill and other equipment. The preliminary work necessary to put this plan into operation would take about twelve months, and milling could not be started before the elapse of that time. Mr. Banks said that the Premier company's offer was under consideration, and at the time he could make no definite statement as to its acceptance or refusal, but he assured the shareholders that their interests would be fully safeguarded should this or any other plan with the Premier company be entered into.

The Consolidated Mining & Smelting Company of Canada gave each of its married employees a turkey for Christmas, and the single employees received an order for merchandise to the value of $3 at the company's stores. The company employs about 4,000 men. At the end of the year, the company disbursed the usual time-service bonuses. Married men who have been employed continuously for the full year received $50 each, and those employed continuously since last June received $25; single men with similar terms of continuous service to their credit received half of these amounts.

Charles C. Bush, of Detroit, has acquired the Arctic group, situated 23 miles north of Ashcroft, having overbid General Motors and the Consolidated Mining & Smelting Company of Canada, who also were negotiating for the property. The group, which contains a deposit of chromite, was explored by the imperial munitions board during the war, and some small consignments of chromite were shipped from it. It is understood that Mr. Bush intends to use the mineral in the manufacture of special alloy steel for the automobile trade.

At the annual general meeting of the Porcupine Goldfields Development & Finance Company, held recently in London, the chairman, F. W. Baker, made the following remarks with regard to the company's activities in British Columbia: "From the Stemwinder property, in British Columbia, shipments of ore were continued to December, 1926, when, in spite of the low operating costs at the mine, operations were suspended for the time being because of the heavy fall in the price of zinc and lead. At the time operations ceased, 28,000 tons of ore had been shipped, and there is a large tonnage of ore of good grade still available. We are now in negotiations to see whether more satisfactory arrangements can be made with the smelters, so that operations on the property can be recommenced on a basis that will be profitable to us. In this we have associates, our interest being one-third.

"On the Yankee Girl mine, which also is situated in British Columbia, an appreciable tonnage of lead-zinc-gold-silver ore has been developed, and there are ore reserves now available of some 48,000 tons, running about $12.50 per ton. Work is proceeding, as indications resulting from present operations are considered favorable."



Above—In the Revelstoke mining district of British Columbia
Below—Diamond drilling at the Wigwam property

Wigwam Company Develops Property in the Revelstoke District of British Columbia

DURING the last summer, about a mile of diamond drilling was done at the Wigwam property in the Revelstoke mining district of British Columbia and more than two million tons of ore was proven in an area of 10¾ acres. Some drifting is now being done on ore above the zone drilled, and diamond drilling will be resumed in the spring as soon as weather permits.

The property is situated 7 miles from Wigwam, which is a station on the Canadian Pacific Railroad, 17 miles southeast of Revelstoke. The tract comprises 36 mineral claims and is being operated under a 99-year lease by the Wigwam Mining Company of Tacoma, Wash.

At a waterfall near the property the Akokolex River has a drop of 415 ft. and a maximum flow of 400 sec.-ft. without storage in the summer and 200 sec.-ft. in the winter. Thus an ample source of power is assured. A small hydro-electric plant has been installed; also a water driven compressor. A substantial camp has been built, including a small sawmill for mining needs. During the last four years, a good wagon road, including necessary bridges, has been constructed from the railroad to the mine by the company. This road follows a water grade after the first mile and a half, which is along the Akokolex River.

Extensive surface work has been done in drifts and open cuts, exposing a considerable tonnage of low-grade ore. Mineralization occurs in an altered limestone, which forms the bedding planes. The limestones are from 600 to 800 ft. thick and have a dip of 23 deg. to the east. Erosion caused by the river and the glaciers makes the development of the property comparatively easy.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Great Activity in The Pas District—Contracts Let by Sherritt-Gordon

TORONTO, JAN. 21.—The Sherritt-Gordon property in northern Manitoba has let a contract to sink two 500-ft. shafts 7,000 ft. apart. One of the shafts has been contracted to Cobalt miners, who will also do 4,000 ft. of drifting and crosscutting. A similar contract has been given to a contractor from the Sudbury district. Four stations will be cut in each shaft at 125-ft. intervals. There is great activity in The Pas district, and the town has never before been so busy. About 1,500 tons of supplies and equipment valued at approximately $70,000 is being moved to the Sherritt-Gordon property. The distance from the railway to the property is about 78 miles, and both horses and tractors will be used in transporting the material. Included in the shipment are 75,000 gal. of fuel oil and 25,000 gal. of gasoline. The mining plants are oil-burning, but there will be auxiliary gasoline and wood-burning units.

RECENT discoveries on the McIntyre Mines of Porcupine have been important and are opening up possibilities of a new area at depth. On the south side of the lake, in the vicinity of the original No. 1 shaft, there were several veins which were worked from the surface, in which the mineralization disappeared at a few hundred feet, where the veins entered the porphyry. Further work was then concentrated on the north side of the lake, and since that time the veins on the north side have supplied almost the entire tonnage. Some time ago a diamond-drill hole was drilled from the 2,000 level into the south area and cut 12 ft. of high-grade ore. This ore is believed to be the downward extension of one of the original veins below the porphyry, so the chances of picking up extensions of some of the other veins are considered promising. A crosscut is being run toward the ore cut by the diamond drill, and is now within a short distance of it, so that further information should be available within a few weeks. The ore cut by the diamond drill carried considerable free gold and assayed much higher than the average of the mine. This new development is considered to be one of the most important on the property during the last few years. On the 2,875 level another oreshoot has been found on the No. 14 vein, which was opened up from the new No. 11 shaft. This is the second shoot to be found in the 14 vein in this section, the first having a length of 500 ft. Crosscuts are being driven from the new shaft at 1,750, 2,250, 3,250 and 3,875 ft. All of these crosscuts still have a considerable distance to go before entering the favorable zone, so it will be some months before definite information is obtained from these workings. At present the mill is treating about 1,500 tons a day, of an average grade of $7.50.

Public interest in Quebec stocks is now much less than it was a few weeks ago, and as a natural result prices have shown a considerable decline. In an effort to account for this there are all sorts of rumors regarding Noranda, as this is the one company which is producing. The street is full of stories about difficulties at the smelter, including the report of the freezing of the furnace. Though Noranda experienced the usual difficulties that are encountered in starting up any new plant, the smelter is operating quite smoothly. Thirty tons of blister copper are being produced and shipped each day, and in addition to this there are several tons of skulls which have not yet been remelted. The smelter is handling about 500 tons, of which 420 tons is mine ore and 80 tons flux carrying some copper. Crosscuts on the 400 and 500 levels have recently encountered the downward extension of some of the 300 level orebodies.

In a recent issue of the *Ontario Gazette*, there was published a list of 149 parcels of mining lands which are in default for non-payment of taxes and which will be forfeited on June 30 next, if taxes are not paid on or before that date. This issue should be read with great interest by the mining people of Ontario who will remember the last time that claims were thrown open for re-staking on account of the failure to pay taxes. Through an oversight, this procedure was neglected by some of the more important companies, and, among others, the Teck-Hughes, at that time developing into a mine of real importance, was included in the list. Even after publication, which of course describes only parcels by the claim numbers, this oversight passed unnoticed until it was too late to make the payment. A most spectacular race subsequently took place between officials of the Teck-Hughes and other stakers to see who could relocate the ground first. In view of this past experience, the present list will be closely scrutinized, and no repetition of the former occurrence is expected.

Sudbury Basin Mines, Ltd., which is controlled by some of the same interests behind Treadwell-Yukon, owns a large acreage in the Sudbury district adjoining the Errington mine on what is believed to be the extension of the ore zone. A diamond-drill hole recently completed on the property penetrated the fault zone along which the orebodies are found and also cut several feet of lead-zinc-copper ore similar to that at the Errington.

On the 19 level of the Teck-Hughes mine, in Kirkland, drifting has recently shown a rich section, a portion of which is 6 ft. in width and 40 ft. in length; neither the complete width nor length is yet known. The high grade of the ore going to the mill is reflected in earnings, which are in excess of present dividend requirements.

London Letter

BY W. A. DOMAN
Special Correspondent

Proposal to Control Output of Lead and Zinc Announced

LONDON, JAN. 10—"Control" seems to be in the air and to be regarded as a specific for lack of consumption. Recently there was rubber control, which has not proved the success it was expected to be. There are two reasons for this: first, the difficulty of inducing all producers to agree, and, second, the secrecy with which the American trade acts. Then the question of tin was raised, and this so far remains unsettled, and from what can be gathered is likely to remain in the same indeterminate status for some time. Now the control of lead and zinc is being attempted. On the basis of a discussion with a well-known authority on the advisability of controlling the former, it appears that this proposition, too, does not meet with wholesale support. That negotiations have taken place is known, but nothing of importance leaked out until, at the recent meeting of the Sulphide Corporation, Ltd., the Earl of Kintore spoke of the great difficulties of bringing about a real working agreement among producers to regulate output. But these difficulties, he added, were not insuperable, and tentative steps had already been taken in the direction indicated. It is thought rather strange that an Australian company should have been the first to mention the proposal publicly.

THE price of lead is now little more than half what it was two years or so ago, when it was forced up owing to talk of a world shortage. But this very high price seems to have brought about the present position. It enabled several mines, not too rich and not too economically worked, to produce a large quantity of the metal, and with supply exceeding demand, the inevitable and obvious has happened. Although producers agree that stabilization is desirable, they do not feel assured that adequate means are available for bringing it about. If prices are raised by restricting output, trade will suffer and the measure will defeat its object. It would, in fact, be wellnigh impossible to control world production, as some of the mining companies regard the present level of prices as quite reasonable, seeing that they are able to pay dividends, and substantial ones, on their capital. To a great extent it seems to be a question of costs.

It is reported that an international zinc syndicate is being formed, to include leading producers in Great Britain, Belgium, Germany, and Poland, and it is hoped, America, in order to raise the price of this metal. This presumably is the syndicate which received considerable attention some weeks ago.

Mexico City Letter

By W. L. Vail
Special Correspondent

Diplomatic Negotiations Suspended During Conference

Mexico City, Jan. 14.—Diplomatic negotiations between the President of Mexico and the American Ambassador have been suspended until Mr. Morrow returns from the Pan-American Conference in Cuba. He is not expected back in Mexico till the first or second week in February. No time will be lost, however, in the general committee work pertaining to legislative matters. The feeling is that Ambassador Morrow has really laid the foundation for successfully solving some of the most troublesome problems, and all those who wish Mexico well hope that his efforts will be entirely successful.

The new pump station of the recently completed drainage tunnel for dewatering the Ojuela mine, Durango, will soon be finished and will discharge approximately 10,000 gal. per minute. The tunnel was driven at an unusual rate of speed, a maximum of 1,001 ft. being accomplished during December, and an average of 714 ft. per month. Mechanical equipment was used wherever possible. With the exception of American shovel runners and shift bosses, the crews were mostly Mexicans. The work was on company account, a bonus being paid when progress exceeded 600 ft. per month.

THE resolution adopted by the minimum wage board of the Santa Eulalia municipality, Chihuahua, has been the source of considerable unfavorable comment on the part of many of the most serious newspapers of the country, as well as causing adverse criticism from mining boards and chambers of commerce. It is the opinion of newspapers generally that the determination of a minimum wage is a very serious problem, that the practical application of such a law is difficult, and in many instances attended by serious consequences. A suggestion is made that to avoid the worst effects of the minimum wage decree, some authority should be named to exempt from certain obligations all enterprises unable to pay the minimum wage established by the respective boards. It is pointed out that if it is attempted to insist on this law a large number of minor employees of the government will come under its rulings and materially unbalance the present financial budgets, and also force an increased taxation to meet the new demands. It is stated by good authority that attempts to enforce the minimum wage in other sections have invariably failed to bring about the results hoped for by enthusiastic dreamers.

The Chontalpan properties, in Guerrero, are encountering rich ores and expect to have a cyanide plant in operation during the month of February. A selective flotation plant began work on the first of this year and made a number of satisfactory trial runs, and shipments of concentrates have been already reported. The management has worked under a series of disadvantages, but feels quite enthusiastic over the present prospects. Adjustment work is being carried on at the old Huautla mine belonging to the Cia. Minera Santiago y Anexas, at Morelos, where a selective flotation unit, a cyanide plant, and large power plants are being installed. The Huautla, which is operated by French capital, has been idle for years, but it was formerly a large producer. Achotla, Guerrero, expects to begin operations on the first of February; work is being pushed on the road to connect with the railway at the Balsas River.

From Lower California comes the report that the former governor of the northern district of that territory, Estevan Cantu, has recently denounced some apparently valuable gold properties in the Punta Prieta desert, about halfway down the peninsula and some five leagues from El Marmol property. Arrangements have been made to install modern machinery and push the development of this property at once. It is also reported that T. H. Boeker has recently returned to Ensenada from the City of Mexico, where he secured an extension of rights over a number of gold-quartz veins in the old Alamo district, a few miles east of Ensenada and at one time the scene of a wild placer rush.

The mining department in this city issued 415 concessions for exploration work during 1927, and 405 concessions were granted for exploitation of properties. The extent of ground covered was 7,771 hectares. Most activity was shown in the State of Chihuahua, with 113 concessions for exploration and 120 for exploitation; for Sonora, there were 62 concessions for exploration and 83 for exploitation; in Durango, 53 for exploration and 35 for exploitation. Jalisco, Guerrero, Oaxaca, Sinaloa, and the State of Mexico followed in importance, respectively. A number of concessions were declared forfeited at the end of the year for failure to comply with provisions of the mining code. Many of these were originally taken up for speculative purposes and later abandoned.

Machinery is being installed to work the new gold property, Flor y Anexas, near Sabinal, Chihuahua. This property was worked for several months by some Japanese mine operators, who took out a number of carloads of high-grade ore. The property is now owned by General Caravejo and Roberto Ateca, who are financially able to push its development.

Owners of the Reina de Plata, formerly the property of the late D. B. Smith, in the Cusi district of Chihuahua, are crosscutting and drifting preparatory to starting active mining operations. Most of the properties in the Cusi district, according to recent reports, are doing well.

Johannesburg Letter

By John Watson
Special Correspondent

November Milling Results at Eighteen Mines Published

Johannesburg, Dec. 17 — The following results of crushing, for the month of November, from eighteen leading Rand gold mines, have recently been published. The mines are arranged in order of profits earned:

	Tons Milled	Value, or Revenue £	Costs per Ton s.	Costs per Ton d.	Estimated Profit £
Government Areas	200,000	385,128	16	3.1	225,171
New Modder	134,000	316,584	19	8.5	184,513
Crown Mines	198,000	289,674	21	2.9	79,396
Modder Deep	44,200	99,630	15	5.0	65,897
Spring Mines	69,600	134,694	20	2.1	65,077
New State Areas	75,000	130,842	20	7.9	54,053
Brakpan	78,000	131,616	20	9.0	50,702
Van Ryn Deep	63,000	105,383	18	0.2	50,142
Modder B	67,000	109,910	18	0.0	49,609
Geduld	82,000	114,842	16	6.0	47,168
Sub Nigel	20,000	.....	42	4.9	44,140
Randfontein Estate	201,000	200,055	17	8.5	25,431
West Springs	48,700	73,948	20	1.2	25,003
Langlaagte Estate	83,000	101,945	20	1.6	22,044
Con. Main Reef	58,000	96,345	25	9.6	21,514
Modder East	60,000	79,416	20	5.4	18,057
Robinson Deep	70,000	.....	20	3.5	15,096
Simmer & Jack	69,200	.....	18	7.5	10,041

At the No. 4 shaft of the City Deep, John Martin, the chairman of the company, started up the new electric winding hoist, on Dec. 1. This electric winder is said to be the largest in the world. At each lift it delivers eight tons of ore from a depth of 4,500 ft. The speed of winding is 3,100 ft. per minute, and the tonnage of rock handled will equal 250 tons per hour. One hundred men can be raised or lowered per trip. The electrical part of this equipment was manufactured by the Metropolitan Vickers Electrical Export Company, Ltd. The cables used are made on the Rand by Haggie, Son, & Love, Ltd.; they are 2¼ in. in diameter.

THE New Morro-Velho G. M. Company, Ltd., restarted crushing on Dec. 1. This company recently took over the property of the Komati United Mines, Ltd., which includes the old Sheba Queen mine, near the Komati River and about 15 miles from Oshoek and the Swaziland border. The present operating organization is a Durban, Natal, company. Registered shareholders of the Komati United Mines, Ltd., will receive one share in the new Morro-Velho for every two shares held in the Komati United Mines.

For the week ended Nov. 26, the customs department reports that there was shipped to India, from South Africa, gold to the value of £226,809. To the United Kingdom, there was shipped gold coin to the value of £14,648; to Zanzibar, £460; to India, £10,000; to Ceylon, £80,000; Brazil, £1,000,000; Portuguese East Africa, £1,500, and to the Dutch East India Islands, £20,000.

Societies, Addresses, Reports

Small Comfort for Zinc Miners

Mining and Metallurgical Society Discusses "Spelter" Industry—Dr. Ingalls Forecasts Price Below Rather Than Above 6.242c.

By A. B. Parsons
Associate Editor

WALTER RENTON INGALLS, dean of prophets and historians of the zinc industry—or the "spelter" industry, as he calls it with last-ditch persistence—does not find much in the outlook for this year or next to make producers of the metal optimistic. He is inclined to think that there is more likelihood of the price in 1928 falling below the average of 1927 (6.242c., in St. Louis) than of exceeding it. As to the more distant future he has more confidence, he told the members of the Mining and Metallurgical Society of America at the joint meeting of the New York Section and the parent body at the Harvard Club in New York on Jan. 12, 1928.

The occasion was the annual meeting of the national organization. Clinton H. Crane, who succeeds himself as president, suggested in his inaugural remarks that the fact that he was entering a third term, in spite of definite protestation that he did not "choose" to be a candidate, might be taken as a portent of the outcome of another election that is to take place in 1928. He also made the proposal that, in view of the far-reaching effects of selective flotation in the metal-mining industries, it would be an appropriate enterprise for the society to undertake to ascertain to what man or men the chief credit should go for the conception and development of the process. That many contributed he did not doubt, but he felt that an authentic record of these contributions might be compiled to good advantage. Mr. Crane later took occasion to correct any mistaken conclusion to the effect that he had any doubt as to whether selective flotation had been an unalloyed blessing. It was, of course, even though it had helped many others more than it had helped the St. Joseph Lead Company.

Percy E. Barbour, secretary, read the report of the tellers who had counted the letter ballots for the election of officers for the current year. The names of the men chosen are shown in the accompanying list. J. R. Finlay reported "progress" for the subcommittee on lead; and Arthur Notman outlined a program that he hoped to put into effect this year for the work of the committee on mine accounting. He proposed that a series of hypothetical "cases" be assumed covering different classes of mining operations and that model systems of accounting be worked out to reflect as accurately as possible the exact status of the enterprize, for the benefit of operators, company officials, stockholders, and the investing public.

New Officers of the Mining and Metallurgical Society of America

President—Clinton H. Crane

Vice-president — G. Temple Bridgman

Secretary-treasurer—Percy E. Barbour

Councillors — W. R. Ingalls, of New York; R. A. F. Penrose, Jr., of Philadelphia; W. C. Browning, of Los Angeles; and F. A. Thomson, of Moscow, Idaho.

These preliminaries being concluded, the way was cleared for Dr. Ingalls and his exposition of the zinc-spelter situation. He pointed out that in addition to the trinity of production, consumption, and price, three other elements must be included in an analysis of the present position and an estimate of the outlook. These considerations he said were (a) accumulated stocks, (b) potential supply, and (c) equipped producing capacity. Also, allowance should be made for human factors: misinterpretation, miscalculation, selfishness, and differences of opinion, which would influence the operation of the other elements.

"Two years ago," said Dr. Ingalls, "we were looking for a continuance of the rising trends in lead and zinc prices, which reflected the thoughts that easy supplies were diminishing, that higher prices would be necessary to evolve more costly supplies, and that the major producers would resist temptation to make additions to plant and extract their ore reserves more expeditiously. We discerned a similarity in the conditions of lead and zinc, but in different degree, the tension in zinc being obviously milder than in lead. The swiftness with which we were refuted by events, especially in zinc, was dramatic. We underrated, among other things, the rapidity and extent of the adoption of the process of selective flotation. Within six months there was a change from scarcity in the supply of zinc concentrates to superfluity."

Dr. Ingalls then reviewed the statistics for the last two years. He showed the rather drastic decline in price from 7.62c., St. Louis, as the average for 1925, to 6.25c. for 1927—a figure that at the moment looks high. In 1926 world production increased 9 per cent and in 1927 a further 6 per cent. But consumption in the world almost kept pace with the increase in production, so that on their face the statistics do not look bad. One of the "blights" on the zinc industry is that it "knows so little with respect to itself" statistically, according to Dr. Ingalls, although on this point he could easily get an argument. The only conclusion to be reached from the continuance of production at a high rate in the face of a sharply declining market is that production costs on the average have been reduced. He continued:

"It is almost unnecessary to offer any further explanation as to why the spelter market was depressed in 1927. It is clear that the advent of the process of selective flotation, bringing in many new producers in Utah and Idaho, was responsible for the fundamental change in conditions. The Anaconda Copper Mining Company was innocent in that it was not a producer of ore, but only a beneficiator on toll, so to speak. The new producers were the several mining companies of Bingham, Park City, the Coeur d'Alene, and elsewhere. They produced all they could for the reason that by virtue of the better grade of their ore they could produce more cheaply than the mines of the Tri-State district and could earn a profit even at a lower price for spelter."

The following table shows the increase in the supply of flotation concentrates:

	1924 Concentrate, Tons	1926 Concentrate, Tons
Canada	128,000	207,000
Mexico	35,000	200,000
Rocky Mountains[a]	220,000	400,000

[a]United States.

The totals for 1927 will be still larger than those for 1926. The Tri-State district suffered severely; in 1926 the production of concentrate was 865,000 tons, compared with only about 694,000 in 1927. The following table shows the estimated production from virgin ores in the United States for the last two years:

	1926	1927
High grade	143,000	150,000
Common (Tri-State)	400,000	315,000
Common (all other)	75,000	140,000
Total	618,000	605,000

The high-grade spelter is the product of Anaconda (electrolytic) and Palmerton (distilled). The common spelter produced from other than Tri-State ore is in the main derived from Western ore.

"The facts that on a declining market the production of spelter from Western ores, whether beneficiated electrolytically or pyrometallurgically, increased, while the production of spelter from Tri-State ore decreased, betray," said the speaker, "that the latter is the more costly and was competitively excluded. In maintaining their production at recent price levels the Tri-State producers have been probably to a large extent sacrificing their principal—that is, disregarding amortization charges. But at the end of 1927, with ore at $35 to $36, and only about 50 mills out of 150 in regular operation, and weekly production down to 6,800 tons per week, the tale for this district has been told."

Dr. Ingalls spoke reassuringly of the

outlook for the per-capita consumption of zinc and the other non-ferrous metals in the United States, although he hedged by saying that Nature uses extreme ingenuity in springing surprises to the discomfort of humans. As to new production, the increase in the electrolytic supply is certain.

"The Rhodesia Broken Hill Development Company begins this month at the rate of 20,000 tons a year. The new Anaconda plant also begins this month. The Kellogg plant follows. These three will contribute 100,000 tons a year, but they will not attain that figure in 1928.

"Toward the end of 1928 and thereafter there will be further new electrolytic production—Asturienne, Penarroya, Buchans, Sudbury, Flin Flon, and others. The fruition of all of this will stretch over several years, probably five. The Flin Flon plans contemplate beginning in about three years, but that seems to me to be optimistic.

"There will also be additional supply of metal that may be expected from the improvement of the metallurgical methods of existing plants, but this likewise will be diffused over several years. The American zinc distilling practice is launched on a program of modernization, which is going to cost 20 to 40 per cent of plant reproduction cost. The plants that are not modernized will pass into the discard."

This, thought Dr. Ingalls, did not paint a particularly rosy picture. He pointed out, however, that just as two years ago the industry was obsessed with the idea that the world faced a scarcity of supply, it might now be dwelling too much on the thought that there is a superfluity of the metal. He turned then to the matter of consumption and discussed it at some length. He explained the effect of the growing tendency of the American people to spend surplus income on automobiles, radios, and electrical appliances, and the requirements for zinc represented in the manufacture of these things. From an average of 5⅝ lb. per person in the period from 1919 to 1921, consumption had increased to 9¼ lb. in the period from 1925 to 1927. The takings of European countries are likewise increasing, though from a slightly different cause—namely, the expansion of their export trade.

What of the ore supply of the future? "Picher and Miami," said Dr. Ingalls, "are waning districts. The older zinc mines of Butte are declining. The Morning mine, in the Coeur d'Alene, has no long life. The Pecos mine, while new, is a short-life mine, so far as yet known. We may be suspicious of some of the mines in Utah that are now making so large a production.

"I do not know of any zinc mines now producing in the United States whereof ten years from now we may be sure of the maintenance of production at the present rate except the Sterling and Franklin mines, in New Jersey; the Mascot, in Tennessee; and the Star, in the Coeur d'Alene. I do not know of any major zinc mines that are being held in reserve except the Orphan Girl, at Butte, and the Gilman, in Colorado. I do not know of any promising new developments except the Pine Creek section of the Coeur d'Alene and at one place in Tennessee.

"Outside of the United States there are brilliant prospects in Manitoba, in Ontario, in Quebec, and in Newfoundland. In Peru there is Cerro de Pasco. In Europe there are great possibilities in the old districts of Reocin, in Spain, and Upper Silesia, in Poland. Tasmania has the Roseberry mines, already well proved, and Australia has Mount Isa, with possibilities. In Siberia the Soviet government may eventually let the Ridder mine become fruitful."

One interesting point made was that the United States tariff of 1¾c. per pound, which now is in effect a dead letter, may become operative and raise a barrier separating us economically from the rest of the world, just as is the case with lead today. This will arise—if it does arise—from the fact that in a few years the supply of zinc from mines within the borders of the United States will be inadequate to supply domestic requirements and that the deficiency will have to be made up from foreign production, which is sure to expand.

Declining to venture to forecast any specific price levels, Dr. Ingalls remarked, "The determinative factors are, first of all, consumptive demand. Next, the extent to which producers are constrained by their plant equipment, transportation facilities, and labor supply. And, finally, the prospect of new producers coming into being. We think that the outlook for lead is still good, for the main reasons that consumption continues to increase and we do not discover new mines. The outlook for zinc is different in that while consumption continues to increase we do discover new mines."

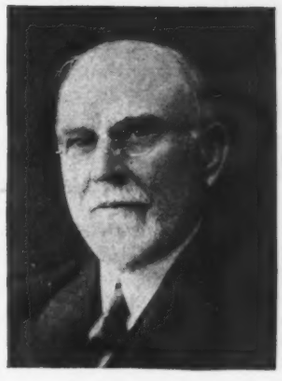
Remarking that a cartel among the zinc-smelting interests is an impracticable solution of the present difficulties because of the broadening international aspect of the industry, and the incidence of American trade laws, Mr. Ingalls offered the following advice to the mine operators: "I think that those companies that are hoarding their zinc ore resources will in the end make more out of them than by expediting production; that those that have already begun equipping need not be in too great a hurry; and that those who are now producing at less than economic cost will find it more profitable in the long run to ease up for a while. It is the miners who should think on these lines. The metallurgists will of course convert whatever ore is offered to them."

Before the meeting was concluded S. S. Tuthill, secretary of the American Zinc Institute; Victor Rakowsky, of Joplin; H. I. Young, of Mascot, Tenn.; and C. V. Drew, of Cerro de Pasco, contributed to the discussion. Allan Rogers rather belligerently brought up the subject of geophysical prospecting, declaring that it would one day be the same kind of a "curse" to metal mining as selective flotation had been—but no one undertook to knock the chip off his shoulder.

Secretary Hoover Appoints Tokio Congress Committee

Membership Includes James H. McGraw, President of the McGraw-Hill Publishing Company

APPOINTED by Secretary Herbert Hoover, as honorary chairman, seventy-eight of the nation's most prominent engineers and scientists have accepted membership on the American Committee of the World Congress of Engineers, to be held in Tokio in November, 1929, according to a recent announcement made by Elmer A. Sperry, chairman of the National Research Council.



JAMES H. MCGRAW

Promotion of international co-operation in the study of engineering science and problems in all its branches, and stimulation of a sense of brotherhood among engineers of the world, are the announced purposes of the Congress, which will be the first one ever held, as set forth by Baron K. Furuichi, president of the Engineering Society of Japan.

Departments of various governments, universities, institutes, and associations are invited to take part in the sessions, which will cover a period of two weeks. The entire enterprise is under the sponsorship of the Japanese government.

Among well-known members of the American Committee are: Thomas A. Edison; John Hays Hammond; Samuel Insull; William B. Mayo, of the Ford Motor Company; Charles M. Schwab; Gerard Swope, president of the General Electric Company; Samuel M. Vauclain, president of the Baldwin Locomotive Works; Daniel Willard, president of the Baltimore and Ohio Railroad; Orville Wright; General William Barclay Parsons; James H. McGraw, president of the McGraw-Hill Publishing Company; H. H. Westinghouse, of the Westinghouse Air Brake Company; Alfred Sloan, Jr., president of the General Motors Corporation; Michael I. Pupin, of Columbia University; and William Green, president of the American Federation of Labor.

Output of Metals From Nevada Mines in 1927

THE value of gold, silver, copper, lead, and zinc in Nevada decreased from $24,549,991 in 1926 to about $22,948,000 in 1927, according to a preliminary statement prepared by the U. S. Bureau of Mines. There was a decided increase in the output of copper, but the other metals, especially gold and silver, decreased. The increase in copper, equivalent to about $1,000,000, was not sufficient to balance the other decreases, especially since the average metal prices were much less than those of 1926.

Gold output decreased from $3,625,461 in 1926 to $3,013,400 in 1927, on account of the closing of the large mill of the Comstock Merger Mines. The company was the leading producer of gold and silver in the state in 1926, but the Nevada Consolidated mine, at Ely, took first place in 1927. It was followed by the Elkoro property, at Jarbidge; the Consolidated Coppermines, at Kimberly; the Flowery Mines, at Virginia City; the White Caps, at Manhattan; the Tonopah Mining and Tonopah Extension, at Tonopah; the Goldfield Consolidated tailings, at Goldfield; the Tonopah Belmont, at Tonopah; and the Round Mountain properties, at Round Mountain. The gold output from Storey County (Comstock district) decreased from $1,181,277 to $217,000. In 1925 and 1926 mines in the Comstock district produced more gold than those in any other district in the state, chiefly as a result of the output of the Comstock Merger Mines, but in 1927 the Robinson (Ely) district was first, the Tonopah district second, the Jarbidge district third, and the Comstock district fourth. The largest increases in the output of gold were made by the Consolidated Coppermines, Nevada Consolidated, White Caps, Gold Circle Consolidated, Goldfield Consolidated tailings, Tonopah Extension, and Tonopah Mining Companies. Decreased production was reported by the Comstock Merger, Elkoro, Tonopah Belmont, Round Mountain, United Eastern, and West End Consolidated companies. The Bradshaw was organized early in the year to work the old tailings at the Goldfield Consolidated property, and considerable gold was recovered by cyanidation. The property of the Rochester Silver Corporation, a large producer of gold and silver in the past, was operated late in the year by lessees, who shipped considerable gold-silver bullion. White Caps mine, at Manhattan, again became a large producer of gold recovered from ore smelted at Thompson. One of the interesting features of the year was the large production of gold made by the Gold Circle Consolidated Mining Company, which operated a new 100-ton cyanidation mill at Midas. The United Eastern Mining Company, a large producer in 1926 from the Bluster property, made its final shipment of bullion in March, after which the lease was relinquished.

The silver production decreased from 6,518,983 oz. in 1926 to about 5,415,000 oz. in 1927, and the value from $4,067,845 to $3,070,300. The decrease in silver was also caused chiefly by the unusual decline in the Comstock district following the closing of the Comstock Merger mill. Output from the Comstock district (Storey County) decreased from 1,534,116 oz. to about 32,300 oz. The Tonopah district produced about 2,131,000 oz. of silver, a slight increase from 2,052,956 oz. in 1926, owing in large part to the increased outputs of the Tonopah Extension and Tonopah Mining properties. The Betty O'Neal mine, at Battle Mountain, was the largest silver producer in the state, followed by the Tonopah Extension, Tonopah Mining, Consolidated Cortez, Tonopah Belmont, and Bristol Silver properties. Other large silver producers were the Tonopah Divide, West End Consolidated, San Rafael, Rochester Silver, Nevada Consolidated, Mason Valley, and Brougher Divide properties. Decreases in the production of silver were reported by the West End Consolidated, Tonopah Belmont, Tonopah Divide, and Combined Metals Reduction companies, but the Consolidated Cortez, Bristol Silver, Betty O'Neal, San Rafael, and Nevada Consolidated companies reported increases.

Copper Production Greater

The copper output increased from 101,827,937 lb. in 1926 to about 117,470,000 lb. in 1927, and the value from $14,255,911 to about $15,271,000. Nevada Consolidated Copper Company, operating its mine, mill, and smelter at Ely and McGill, was by far the largest producer of copper in the state, although the output of copper from its own mine was curtailed. The large increase in the output of copper from the adjoining property — the Consolidated Coppermines Corporation — together with the activity of the Mason Valley property, resulted in a large increase in the copper output of the state. Consolidated Coppermines was second in the production of copper in 1927, and it was followed by the Mason Valley Mines Company, which ran its smelter at Thompson the entire year. The plant received custom ore from Nevada and California, but most of the copper recovered came from the Bluestone and Mason Valley mines near Mason. The Bristol Silver mine, near Pioche, and the Copper Canyon property, in Lander County, were also large producers of copper.

Lead output decreased from 22,367,965 lb. in 1926 to about 16,810,000 lb. in 1927, and the value from $1,789,437 to about $1,138,000. The San Rafael property, at Quartz Mountain, was the largest producer of lead, followed closely by the Bristol Silver Mine, at Pioche. Other large lead producers were the Richmond Eureka, Combined Metals, Yellow Pine, Eureka Holly, Panther, Simon Silver-Lead, Black Forest, and Spruce Consolidated properties. The Eureka Holly property, the second largest producer of lead in Nevada in 1926, was closed in May, and the Simon Silver-Lead Company ceased shipments of lead concentrate in January. The Combined Metals Reduction Company, the largest producer of lead in Nevada in 1926, decreased its output decidedly while doing development work, but large increases were made by the San Rafael, Yellow Pine, Bristol Silver, and Panther companies.

Zinc recovered from ore mined in Nevada decreased from 10,817,833 lb. in 1926 to about 7,250,000 lb. in 1927 and from $811,337 in value to about $455,300. The decrease resulted from the curtailment of production at the Pioche property of the Combined Metals Reduction Company, which was by far the largest zinc producer in Nevada in 1926. Output of zinc-lead mill ore shipped to Bauer, Utah, was only about one-third that of 1926, as mining was restricted while the orebody was being developed at depth. The largest zinc producer in 1927 was the Yellow Pine property, at Goodsprings, followed closely by the Combined Metals property at Pioche. The Potosi mine, at Arden, also produced much zinc ore, which was shipped to a custom flotation plant. The Yellow Pine company more than doubled its zinc output, but did not reach its record of past years. The Argentena Consolidated Mining Company, operating lead-zinc property at Goodsprings, completed the construction of a 100-ton flotation plant late in the year and will probably be a large producer of lead and zinc in 1928.

Output of Metals From Montana Mines in 1927

THE value of gold, silver, copper, lead, and zinc produced from Montana mines in 1927, according to the U. S. Bureau of Mines, was $48,078,000, a decrease from $59,410,453 in 1926. Curtailment of operations at Butte, together with the decrease in metal prices, resulted in a general decrease in the quantity and value of the five metals. A decrease of about 12 per cent was shown in the output of copper, and there was a corresponding decrease in the associated gold and silver.

The value of the gold output decreased from $1,250,731 in 1926 to $1,111,500 in 1927. The largest gold producers in the state were the Anaconda, St. Louis, Liberty Montana, New Gould, Sterling (Keating), Butte & Superior, and Angelica properties. There was naturally a decrease in gold from copper ores, but also a large decrease in gold from gold ores, as the Jardine mine, the second largest producer of gold in Montana in 1925 and 1926, was practically idle in 1927. The Drumlummon mine, at Marysville, operated by the St. Louis Mining & Milling Company, of Montana, was the only large gold producer that increased its output. The Liberty Montana property, near Jefferson Island, a large producer of gold in 1925 but idle in 1926, was active the last seven months

of 1927 and produced considerable gold from copper concentrate. The Jib mine, at Basin, was idle.

Mine output of silver decreased from 12,769,092 oz. in 1926 to 11,097,100 oz. in 1927, and the value from $7,967,913 to about $6,292,000. The output of silver was decidedly less, on account of the curtailment in the output of copper ore from Butte. Mines of the Anaconda Copper Mining Company and the Butte & Superior Mining Company produced nearly three-fourths of the state's silver. Next in order were the Elm Orlu mine, at Butte, the Silver Dyke property, at Neihart, and the East Butte, Butte Copper & Zinc, and Poser mines, at Butte. The Elm Orlu Mining Company increased its output of silver, but the other large producers of silver reported decreases. Considerable silver was recovered from the Angelica mine, in Jefferson County, and from the Granite Bimetallic tailings at Philipsburg.

Copper output decreased from 255,372,862 lb. in 1926 to about 224,600,000 lb. in 1927, and the value from $35,752,201 to about $29,198,000. Decrease of output of copper in Montana, as in other states, was in part a reflection of the decrease of about one cent a pound in average price of copper in 1927. The Anaconda Copper Mining Company, as in the past, produced most of the copper from its mines at Butte. The milling and smelting of copper ore was done almost exclusively at Anaconda, although two mills making copper concentrate were operated at Cascade and Madison counties. Other large copper producers were the East Butte and Butte & Superior mines, at Butte, the Silver Dyke, at Neihart, and the North Butte and Elm Orlu mines, also at Butte.

Lead Production Decreases

Production of lead decreased from 42,306,193 lb., valued at $3,384,495, in 1926, to about 36,500,000 lb., valued at $2,471,000, in 1927. The chief producers of lead were the Butte Copper & Zinc, Butte & Superior, Elm Orlu, Poser, Silver Dyke, and Anaconda properties, each of which produced more than 1,000,000 lb. Other producers were the Angelica, Moulton, Hecla slag dump, East Pacific, and Block P. mines. Considerable lead-zinc ore from the Angelica mine, in Jefferson County, was treated in the Timber Butte mill at Butte, and similar ore from the Queen and Galt mines at Neihart produced much lead. A decided increase was shown in the output of lead bullion from the smelter at East Helena.

Output of zinc recovered from ore mined in Montana decreased from 147,401,507 lb. in 1926 to about 143,400,000 lb. in 1927. Value decreased from $11,055,113 to about $9,005,500. The electrolytic zinc plant near Great Falls was operated continuously, treating concentrate from Anaconda and Butte and custom material, chiefly from Idaho and Utah. The large producers of zinc at Butte were the Butte & Superior, Elm Orlu, Butte Copper & Zinc, Poser, Anaconda, North Butte, Moulton, and Otisco mines. Good increases were made at the Butte & Superior and Elm Orlu mines, but decreases are recorded at the Butte Copper & Zinc, Poser, and Moulton properties. Considerable zinc ore was milled from mines in other districts, especially from the Angelica, Queen, Big Eight, and Galt mines. The improved custom flotation plant for lead-zinc ore was active in Anaconda, and the Timber Butte custom mill, at Butte, continued to treat custom ore and ore from the Elm Orlu and other Clark properties.

Output of Metals From Idaho Mines in 1927

THE value of the gold, silver, copper, lead, and zinc produced from ore mined in Idaho in 1927, according to the U. S. Bureau of Mines, was about $28,469,000, compared with $30,969,551 in 1926. Despite the decline in metal prices there was a decided increase in the output of silver and lead and a slight increase in gold and copper. A small decrease in zinc resulted from unusual local market conditions. Large increases in both silver and lead were made from the Hecla, Bunker Hill & Sullivan, Sunshine, Sidney, Page, Galena, Black Hawk, United Idaho, Wilbert, Whitedelf, Tamarack & Custer, and Strattons properties.

Mine output of gold was valued at $289,400, compared with $282,569 in 1926. The large increase in the output of gold from the Idawa property, near Centerville, was notable, as the mine became the second largest producer of gold in the state. Increases were also made by the South Park Dredging Company at Featherville, the leading gold producer, the Gold Dredging & Power Corporation at Centerville, and the Idaho Metals Company at Mackay. A new producer of gold was the Lincoln mine at Pearl in Gem County. A flotation plant installed in the old mill building was operated during the summer. Considerable gold was also produced by the Boise Placer, Idaho Metals, Mineral, and United Idaho companies.

The output of silver increased from 7,556,444 oz. in 1926 to about 8,616,000 oz. in 1927, and the value from $4,715,221 to $4,885,300. There was an increase in silver produced from lead ores, especially from the Bunker Hill & Sullivan, Hecla, Galena, Whitedelf, and Strattons properties, but the largest increase was in copper-lead concentrate, chiefly valuable for its silver, shipped by the Sunshine Mining Company. An increase in silver produced from lead-zinc ores, chiefly from the Morning, Page, and Sidney mines, is also to be recorded. In the Coeur d'Alene district, which produced 7,892,000 oz. of silver, about 80 per cent of the product was recovered from the ores of the four largest producers, the Morning, Hecla, Bunker Hill & Sullivan, and Sunshine mines. The Tamarack & Custer, Gold Hunter, and Galena mines were also large producers, and the United Idaho, Page, Strattons, and Whitedelf properties followed. The largest decrease was that of the Crescent mine at Kellogg.

Output of copper increased from 1,337,442 lb. in 1926 to about 1,843,000 lb. in 1927, and the value from $187,242 to $239,600. The Idaho Metals Company at Mackay was active the entire year, and its output of copper was nearly three times that of 1926. Other producers of copper were the Oregon-Idaho, Sunshine, Hecla, and Harmony properties. The Oregon-Idaho mill, run on Snow Storm ore, was closed early in the year, and the Harmony mill, in Lemhi County, ran only a short time.

The output of lead increased from 272,980,212 lb. in 1926 to 293,600,000 lb. in 1927, but the value decreased from $21,838,417 to $19,877,000 as a result of the decline in the average price of the metal. Bunker Hill & Sullivan, Morning, and Hecla mines were as usual the largest three producers. The largest increases came from the Bunker Hill & Sullivan, Page, Galena, United Idaho, Sidney, Black Hawk, and Strattons mines. Notable increases were also made by the Hecla, Tamarack & Custer, Sunshine, Wilbert, and Whitedelf properties. The Triumph Development Company was organized to operate the Triumph mine near Hailey, which was a large producer of lead-zinc ore late in the year. Recovery of lead from lead-zinc ores was increased by the improvement at the Morning, Sweeny, and Hercules mill and new mills were operated at the Galena, Page, and Jack Waite properties. The three leading producers of lead were followed by the Tamarack & Custer, Gold Hunter, Page, United Idaho, Galena, Sidney, Strattons, Livingston, Star, Jack Waite, Black Hawk, Wilbert, and Constitution mines.

Zinc Output Less

The zinc recovered from ore and concentrate decreased from 52,614,691 lb. in 1926 to 50,600,000 lb. in 1927, and the value from $3,946,102 to $3,178,000. This decrease was caused not only by the drop in the price of zinc, but by the fact that shipments to Belgium ceased in May when the contract with the Vieille Montagne Zinc Company terminated. Most of the output was recovered by roasting and leaching at Great Falls, Mont., and nearly all the remainder was shipped to Belgium for smelting. About 4,000 tons of high-grade zinc concentrate was shipped a month from the Coeur d'Alene region. The largest producers of zinc were the Morning, Sidney, Constitution, Star, Highland-Surprise, Frisco, Page, and Douglas mines, in Shoshone County, and the Triumph mine, in Blaine County. The Star mine, worked through the Hecla shaft, made its last shipments in March, and the zinc concentrate from Sidney ore was stored until the completion of the new electrolytic zinc plant being constructed by the Sullivan Mining Company near Kellogg.

Metal Mining in Colorado During 1927

THE output of gold, silver, lead, copper, and zinc from Colorado mines in 1927 in terms of recovered and estimated recoverable metal was 259,245 fine ounces of gold, 3,792,206 oz. of silver, 67,566,000 lb. of lead, 5,745,000 lb. of copper, and 74,874,000 lb. of zinc, according to the U. S. Bureau of Mines. These figures are to be compared with 334,339 fine ounces of gold, 4,624,000 oz. of silver, 66,000,000 lb. of lead, 3,350,000 lb. of copper, and 65,000,000 lb. of zinc in 1926. Compared with the 1926 figures, gold shows a decrease of 75,094 oz., or $1,552,335, silver a decrease of 832,000 oz., lead an increase of 1,566,000 lb., copper an increase of 2,395,000 lb., and zinc an increase of 9,874,000 lb. The gross estimated value of the output of metals in Colorado in 1927 is: Gold, $5,359,070; silver, $2,150,181; lead, $4,574,218; copper, $746,850; zinc, $4,702,087; or a total of $17,532,406, compared with $20,482,081 in 1926.

The Cripple Creek district in 1927 produced $3,365,582 in gold, compared with $4,436,012 in 1926. This decrease can be credited to the fact that the grade of ore shipped from the Cresson mine in 1927 was considerably under the average for 1926, and the quantity of what is called higher-grade ores shipped from the Portland mine was very much less than in 1926. The Portland-Independence 1,200-ton, non-roast cyanidation-concentration mill was operated continuously on the lower-grade ore from stope filling, reject from the picking belts, and dump material. Production was steady from the various properties of the United Gold Mines Company. A broken rod on the Cresson hoist prevented shipping for three weeks in November, and a fire in December, which completely destroyed the Vindicator surface buildings, also contributed to the decrease. The Stratton Leasing Company continued work on the Orpha May and Los Angeles claims. Other producing mines were the Elkton, El Paso, Forest Queen, Granite, Midget, Queen, and Rose Nicol. Ore continued to be produced from the Plutocrat claim, a new strike in 1926, on Mineral Hill.

At Canon City, the Empire Zinc Company's magnetic separation and flotation mill was operated steadily throughout the year on zinc-lead ore from stock and new ore from the company's Eagle mines at Gilman. No shipments were made from the Eagle mines after October, and it is probable that the magnetic mill will be closed down. Large blocked-out orebodies of zinc ore at the mine constitute a reserve for many years to come. The Empire Zinc Company's zinc oxide plant, also at Canon City, was operated steadily on zinc concentrates from the company's mine at Hanover, N. M. The River Smelting & Refining Company's fuming and matting plant, at Florence, was idle. At Ilse, Custer County, the 150-ton jig and table-concentration mill at the Terrible mine was operated up to October on the cerussite ores of this mine. Development at lower levels continued after October. At Westcliffe, the crosscuts from the bottom of the new shaft at the Passiflora mine opened the vein at 300 ft. in depth.

The 400-ton flotation mill at the Rawley mine, at Bonanza, was operated throughout the year, producing lead-copper-silver-gold concentrates, which were shipped to Leadville. Development work was continued at the Cocomongo mine. An adit was run on the manganese vein of the Express-Headlight and a car of ore was placed on the dump. At Monarch, Chaffee County, a lessee reopened some of the old workings of the Madonna mine. At Whitepine, Gunnison County, zinc-lead ore was shipped during the first half of the year from the Akron group and from the Morning Star mine. Small shipments of ore were made from Ohio City.

At Aspen, mining was reduced to about 100 tons a day of lime ore from the upper part of the Leadville limestone. Payment was made at the rate of 15c. a unit for the lime. This lime rock contained from 2 to 4 oz. of silver and from 2 to 4 per cent lead. Development work was continued at the Midnight adit. Development work was also started at Aspen in the Cowenhoven adit, to search for ores in the White (or Yule) limestone. The Smuggler mill was idle all year. At Rifle, Garfield County, the 140-ton roasting and leaching plant of the United States Vanadium Corporation was operated steadily. At Gilman, development work was continued at the replacement orebodies of the Eagle mines of the Empire Zinc Company, and both zinc ore and silver-iron sulphide ore was shipped.

At Silver Plume, Clear Creek County, the East Butte flotation mill on the Dives-Pelican-Zero group remained idle. Some development work was done at the Santiago mine and at the West Fork group, at Empire, the Gold Dirt flotation mill producing gold concentrates. Lessees reopened the Jo Reynolds, at Lawson. Picked ore continued to be shipped in small quantity from Idaho Springs from the Sylvanite mine of the West Gold Mines Company. This mine made a very creditable output in 1926, from the surface down to 90 ft., along a length of 100 ft. At the Newhouse (or Argo) drainage adit, the mill at the mouth was remodeled, in preparation for treatment of ores from the Gunnell and Concrete groups, from orebodies below the adit level. Raising was continued on the vein of the Kansas-Burroughs group. The Gilpin Eureka mine and amalgamation mill, at Central City, were operated part of the year. There were shipments of gold ore and bullion from the Perigo and Providence mines, near Rollinsville.

A report of 1927 operations in the other Colorado districts will appear in the Feb. 4 issue of *Engineering and Mining Journal*.

San Francisco Section Elects Officers

ON JAN. 10, the San Francisco section of the A.I.M.E. in the course of a regular meeting elected the following new officers for 1928: Chairman, E. A. Hersam; vice-chairman, Nelson Dickerman; secretary-treasurer, James G. Parmelee; executive committee, H. C. Carlisle and Clyde E. Williams.

R. E. Phelan briefly sketched the results of research in determining methods for the treatment of the Flin Flon orebody in Manitoba. Mr. Phelan said that preliminary experiments at Denver upon 300 tons of the ore had resulted in a method of treatment, but when attempts were made to apply it at the mine in a 30-ton pilot plant, it was found that the ore sample was not representative and a new method had to be worked out. One of the most embarrassing features of the ore is the large proportion of talc—magnesium silicate. This difficulty was overcome by the discovery of a flotation method for the removal of some 90 per cent of the talc as a preliminary treatment. The remaining pulp was then subjected to differential flotation, and a copper, as well as a zinc, concentrate was made. The final residue is to be treated by agitation with cyanide solution for the recovery of the gold and part of the silver. High consumption of cyanide is overcome by regeneration of the cyanide, so that the net loss of cyanide is reduced to slightly over a pound per ton. A 3,000-ton mill is being planned in accordance with the flow sheet developed at the pilot plant.

Charles Butters, in an interesting talk, told about his experiences and the conditions affecting mining in northern Nicaragua.

Nevada Association Holds Annual Meeting

The annual meeting of the Nevada Mine Operators' Association was held in Reno, Nev., on Jan. 9, and the following officers and members of the executive committee were elected for the ensuing year: J. C. Kinnear, president; A. H. Lawry, first vice-president; P. W. Racey, second vice-president; Henry M. Rives, secretary and treasurer; John G. Kirchen, Fred L. Cole, H. A. Johnson, H. D. Budelman, E. A. Julian, and L. D. Gordon, additional members of the executive committee.

University of Wisconsin to Hold Foundry Conference

The department of mining and metallurgy of the College of Engineering and the university extension division of the University of Wisconsin announce a second foundry conference, to be held in the laboratories of the department of mining and metallurgy, on Jan. 31 and Feb. 1, 2, and 3, 1928.

Recent Technical Publications

SPANISH MINES—The Association of Mining Engineers of Spain, with headquarters in Madrid, has issued a bibliography of references to Spanish ore deposits. This is in the form of a pamphlet of pocket size, containing 150 pages, and titled " Catalogo de Estudios de Criaderos Minerales Españoles." The preface states that every study, article, memorandum, or item of information known to the association has been included. The pamphlet is divided into two parts. Pages 9 to 143 inclusive contain the bibliography proper, classified according to province. The remaining pages contain a classification of the preceding references according to mineral or metal, the serial numbers alone of the references being used for this purpose.

GEOLOGY, VIRGINIA—Bulletin 28 of the Virginia Geological Survey is entitled "Fensters in the Cumberland Overthrust Block in Southwestern Virginia." The author is Charles Butts. This bulletin has been prepared in connection with the U. S. Geological Survey. "Fenster" is a German word meaning window. As a geological term, it may be defined as an opening—as for example, in the bottom of a valley—worn by erosion through an overthrust mass of strata and revealing the younger strata beneath the overthrust mass of rocks. The interest and importance of "fensters" lie in the fact that they afford certain proof of the overthrusting, to quote the bulletin.

TRANSACTIONS—Vol. LXXV of *Transactions* of the American Institute of Mining and Metallurgical Engineers has appeared. It contains the papers presented at the meetings held in New York in February, 1927, and in Cleveland in April, 1927. The discussion of the papers is included.

CEMENT, GRAVEL, ETC.—The Annual Review and Directory Number of *Rock Products* contains an admirable summary of conditions in the various industries in this magazine's field, including the portland cement, sand and gravel, lime, slate, gypsum and phosphate industries.

MANGANESE, ASBESTOS, MAGNESIUM —Three more advance chapters of "Mineral Resources of the United States" have been issued by the U. S. Bureau of Mines. These are: "Manganese and Manganiferous Ores in 1926," by J. W. Furness; "Asbestos in 1926," by B. H. Stoddard; and "Magnesium and Its Compounds in 1926," by J. M. Hill. The price of each is 5c. a copy.

SKIP HOISTING — Demag, the mining machinery concern of Duisberg, Germany, issues a quarterly publication known as *Demag News*. The January issue contains an interesting nine-page article entitled "Bucket or Skip Hoisting in Mining."

MARKET DATA—"The Market Data Year Book for 1928," published by G. D. Crain, Jr., 537 South Dearborn St., Chicago, has made its appearance. This book is intended to furnish those interested in the development of specialized markets with the basic facts regarding those fields and the publications which serve them. It contains 463 pages.

MINERAL RESOURCES—Two advance chapters of "Mineral Resources of the United States" have made their appearance. These are entitled, respectively, "Lead and Zinc Pigments and Salts in 1926," by A. Stoll, and "Talc and Soapstone in 1926," by B. H. Stoddard. They are sold at 5c. a copy by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

AMMONIA LEACHING OF ZINC ORES—"Recent Developments in Ammonia Leaching for Zinc Ores" is discussed by H. M. Lawrence in a 12-page booklet recently issued by the School of Mines and Metallurgy, Rolla, Mo., from which it may be obtained on request. Mr. Lawrence gives an abstract of published descriptions of the Waring, Gordon, and Campbell processes, and tells of experimental work carried on at Rolla.

TENNESSEE IRON ORES—U. S. Geological Survey Bulletin 795-D, pp. 60, by E. F. Burchard, describes "The Brown Iron Ores of West-Middle Tennessee." Copies are available for 15c. each from the Superintendent of Documents, Washington, D. C.

NEVADA QUICKSILVER — "Quicksilver Deposits of the Pilot Mountains, Mineral County, Nevada," is the title of a 10-page U. S. Geological Survey Bulletin, No. 795-E, by W. F. Foshag. Obtainable for 5c. from the Superintendent of Documents, Washington, D. C.

MINING UTAH—*The Mining Review*, of Salt Lake City, contains a two-and-a-half page article entitled "Methods of Metal Mining in Utah and Changes Required in Equipment and Practice to Secure Profitable Results." The author is J. A. Norden, mine superintendent of the Utah Apex company.

COPPER—"Stabilization of the Copper Industry" is the title of a long article in the January issue of the *Commerce Monthly* published by the National Bank of Commerce in New York. The author is George E. Eddins.

SPONGE IRON—Bulletin 270 of the U. S. Bureau of Mines, on "Production of Sponge Iron," is out. It contains 175 pages and is sold at 35c. Address the Section of Publications, Bureau of Mines, Washington, D. C.

COPPER—"Drilling and Blasting in Open-Cut Copper Mines" is the title of Bulletin 273 of the U. S. Bureau of Mines. It contains 98 pages and is sold at 30c.

TIN DREDGING—F. W. Payne, in an article entitled "Tin Saving on Dredges," in the December *Mining Magazine*, discusses various mechanical devices for improving the extraction of tin in sluice-boxes.

GEOPHYSICS—Among the other articles in the same issue of the *Mining Magazine* is one entitled "A Gravitational Survey Over the Swynnerton Dyke, Yarnfield, Staffordshire," by W. F. P. McClintock and J. Phemister.

PATENTS

FILTER. No. 1,655,426. Jan. 10, 1928. W. C. Laughlin, assignor to Laughlin Filter Corporation, New York.

A centrifugal machine consisting of a rotatable drum with a filtering screen and other features.

CLASSIFIER. Nos. 1,655,574, 5, 6, 7 and 8. Jan. 10, 1928. Albert H. Stebbins, Los Angeles, Calif.

A classifier consisting essentially of a casing supported in an upright position, down which the material to be classified is passed, being subjected in its passage to the action of jets of air which accomplish the classification of the particles of the material. The last of these five patents covers the supporting frame and operating mechanism.

ALUMINUM. No. 1,655,608. Jan. 10, 1928. R. W. Hyde, assignor to Dwight & Lloyd Sintering Company, Inc., N. Y.

A process of treating aluminum-bearing ores by crushing and sintering.

TITANIUM. No. 1,655,940. Jan. 10, 1928. Jean D'Ans, Berlin, and Fritz Sommer, Charlottenburg-Berlin, Germany.

A process of preparing titanic oxide from titanium ores containing iron.

PHOSPHATE. No. 1,655,981. Jan. 10, 1928. James A. Barr, assignor to the International Agricultural Corporation, New York.

A process of making a substantially water-proof briquette by mixing six parts ground phosphate rock, two parts of pulverized coal and two parts of silica and heating to approximately red heat.

CRUSHER. No. 1,656,004. Jan. 10, 1928. W. E. Keine, assignor to Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

A gyratory crusher.

CONCENTRATOR. No. 1,656,042. Jan. 10, 1928. J. A. Chambers, Johannesburg, South Africa.

An apparatus for concentrating ores and other minerals.

CRUSHERS. Nos. 1,654,638-9, Jan. 3, 1928. P. L. Crowe, Baltimore.

A grinding and separating apparatus, including a fan casing, with several fan units inside. The second of these patents covers the crushing plates.

SINTERING. No. 1,656,115. Jan. 10, 1928. Anders Holmberg, Stockholm, Sweden, assignor to Helge Gustaf Torulf, Stockholm, Sweden.

An apparatus for sintering fine ores or pulverulent ores.

Personal Notes

S. B. McCLUSKEY, of the technical staff of the Mexican Corporation, sailed from New York for London on Jan. 14.

EDWIN C. REEDER, superintendent of Hillside Fluorspar Mines, of Rosiclare, Ill., recently spent a few days in New York on business.

SAMUEL H. DOLBEAR, consulting mining engineer, has moved his offices to 17 Battery Place, New York City.

A. P. SERECROWSKY, professor in the Moscow Mining Academy of the University of Moscow, Russia, is visiting California mining districts.

FRANK L. TRETHEWEY has been elected manager-director of the Ramore mines, in the Larder Lake section of the Kirkland area of northern Ontario.

DOUGLAS BAIRD, geologist for the Dome Mines, is making an examination of the properties held under option by the Dome, in the silver-lead fields of Wawa, northern Ontario.

JAMES RATTRAY has been appointed mine manager, and DOUGLAS WRIGHT, consulting geologist, of the Kirkland Eastern Gold Mines, Ltd., in the Kirkland Lake area of northern Ontario.

R. T. MISHLER has been appointed general manager of the Lucky Tiger-Combination Gold Mining Company, to succeed L. R. BUDROW, who becomes vice-president and consulting engineer.

RALPH T. HIRSH, engineer for the New York Alaska Gold Dredging Company, is in New York and will remain there until the first part of April.

R. G. AMIDON, of R. G. Amidon & Company, Inc., of Oregon, has taken over the management of the Buffalo Mine, a gold and silver property near Granite, Ore. Mr. Amidon is in active charge at the property.

F. K. BRUNTON, who is connected with the Tom Reed Gold Mines, has temporarily made his headquarters in Tucson, Ariz., while the mine is undergoing repairs. Mr. Brunton may be reached at 2333 East First St., Tucson, Ariz.

H. R. ROBBINS, for the last six years special foreign representative for the American Cyanamid Company, has been appointed consulting metallurgical engineer for the Oriental Consolidated Mining Company, at Hokuchin, Chosen.

HARRY OAKES, president of the Lake Shore Mines, has presented the town of Kirkland with a covered ice-skating rink erected at a cost of $75,000 which was officially opened on Jan. 10. Mr. Oakes has taken a prominent part in developing the Kirkland Lake area.

NOAH A. TIMMINS, president of Hollinger Consolidated, and A. KIRK CAMERON, of Montreal, have purchased the home of the late Sir Wilfred Laurier, for many years Premier of Canada, at Arthabaska, Que. They will present it to the Government of Quebec to be kept as a museum.

GEORGE W. STARR, manager and director of the North Star Mines, of Grass Valley, Calif., and Dr. CARL P. JONES, also of Grass Valley, have left for New York, where they will be joined by NED BARRY. At Paris C. B. LAKENAN will also join the party, which will then proceed to Johannesburg, South Africa.

Lady ABE BAILEY, according to dispatches from Paris, has been awarded the international trophy for women by the International League of Aviators. Lady Bailey is the wife of Sir Abe Bailey, the prominent English mining financier. Lady Bailey has been particularly interested in trying for altitude records.

Brig.-Gen. CHARLES A. SMART, of Westmount, Que., has gone to New Brunswick to make an inspection of the antimony mines at Lake George which are being transferred from the North American Antimony Smelting Company, Ltd., to The Canadian International Corporation. The latter company is also interested in the copper deposits at Annidale, King's County, and General Smart's visit is connected with test shipments of the ore.

H. Y. WALKER, general manager of the Western department of the American Smelting & Refining Company, was made vice-president at a recent directors' meeting. At the same time, four other promotions were announced. R. F. McELVENNY, manager of the Tacoma, Wash., smelter, is to succeed Mr. Walker. He is succeeded, in turn, by A. H. RICHARDS, consulting metallurgist of the company at New York. B. N. RICKARD becomes manager of the El Paso, Tex., smelter after having held a similar position at East Helena, Mont. J. D. McKENZIE, till now metallurgist of the Utah department, is to take Mr. Rickard's place.

OBITUARY

FRANK P. CRANE, a Denver mining man, died recently at San Diego, Calif. Mr. Crane was 72 years old.

FRANK E. GRANT, superintendent of steam shovels for the Nevada Consolidated Copper Company at Ruth, died Jan. 14 at East Ely, Nev.

O. M. CARTER, mine owner and inventor of the Carter collapsible rotary drill, died recently at the age of 87, in Houston, Tex. Mr. Carter perfected his rotary drill when he was 77 years old.

WILLARD PARKER WARD, at one time an associate editor of *Engineering and Mining Journal*, died at Savannah, Ga., on Jan. 17. He was 82 years old. Mr. Ward was born in New York City in 1845. After finishing an A. B. course at Columbia University, he went abroad and studied in Germany for four years at the mining schools of Berlin and Clausthal. He returned to America in 1869 and started practice as a mining engineer. On April 25, 1871, his name first appeared on the *E. & M. J.* editorial page as co-editor with Rossiter W. Raymond. Soon thereafter he took an active part, together with Raymond, Rothwell, and others, in the formation of the American Institute of Mining and Metallurgical Engineers. Subsequently, Mr. Ward became the first maker of ferromanganese in the United States, introducing it in 1874. He then became interested in mining gold and silver, an interest which he kept throughout the remainder of his active career. As a result of continued studies, he won honors in the academic field, receiving an A.M. from Columbia in 1871 and a Ph.D. from New York University in 1875. At the time of his death, he was one of the two surviving members of the A.I.M.E. who had been present at that first official meeting in Wilkes-Barre on May 6, 1871. He maintained an office in New York until 1925, when poor health forced him to take up residence in Savannah.

MICHAEL H. GODFREY, manager of the Oliver Iron Mining Company, at Hibbing, Minn., died recently in that city. Mr. Godfrey was born at Champion, Mich., on April 13, 1872. His career, during which he rose from ordinary mine helper to mine manager, was from the first firmly bound to the great iron mining industry of the region in which he was born. The following appreciation is contributed by one of Mr. Godfrey's former associates:

Michael H. Godfrey, one of the best known and best loved figures in Lake Superior mining, has gone. Unpretentious and unassuming, but with a keen faculty of human understanding, he occupied a place in the hearts of all those associated with him which is attained by few. To the younger men of the Mesabi—he himself was only 55 when he died—he gave the encouragement and the friendship that mean so much; to the older men his judgment and experience made a tremendous appeal. The great projects of the range—the Hull-Rust, the Coleraine holdings of the U. S. Steel Corporation, and other notable open-pit and underground properties—were at one time or other under his actual supervision, and the advances made during his tenure of office are outstanding in the annals of Lake Superior mining. It was because of his complete understanding of men and methods that he was generally recognized as a powerful factor in mining and civic affairs on the range.

To those of us who knew him, the news of his passing came as a distinct shock, for although he had been seriously ill for two years previous to his death, it was felt that his driving energy and will power would eventually pull him through. His accomplishments, his loyalty to friends and associates, and his devotion to duty remain as splendid examples to the entire mining industry.

D. E. A. CHARLTON.

New York City.

Market and Financial News

Sees Better Prices for Zinc Next Summer

By the International Metal Service, London, Correspondent of the American Zinc Institute, Inc.

PERHAPS the less said about the disappointments of the last year the better. Misfortunes were not confined to the members of the zinc industry in America; producers in Europe and ore suppliers in Africa and elsewhere had their fair share of troubles also.

The closing quotation for G.O.B. spelter—or, in other words, Prime Western zinc—on the London Metal Exchange on Dec. 30 was £26 5s. per long ton, which contrasts with £32 15s. on Jan. 1, 1927.

Complete figures are not available at the time of writing, so that our preliminary estimate of 1,320,900 metric tons as world production for last year may need slight revision later. Now, having regard to the fact that such a production is a world record it is almost unbelievable to those not in the trade to learn that the zinc industry did not enjoy a year of prosperity, especially as consumption was likewise a record and world stocks of the metal were fairly modest. But somehow or other confidence has been entirely lacking in the zinc market, and the price slumped in sympathy with lead, of which there was a superabundance, indicating overproduction.

With industrial affairs progressing satisfactorily in the Old World, and the promise of no retrograde movement in trade in the United States, consumption this year should also break a record.

For reasons that need not be traversed here, we expect a distinct advance in the selling price of lead by the summer. In brief, there is scope in our opinion for a fair advance in the zinc market this year; indeed we regard the current quotations of 5.65c. per lb. in St. Louis and £26 2s. 6d. per long ton in London as substantially below the intrinsic value or what should be the basic price for Prime Western at the present time. The next upward movement will be assisted if output be regulated so as to curb an increase in unsold stocks in the hands of smelters, the majority of whom are ever disposed to realize, in preference to nursing markets by holding back for higher prices. It may be observed that during 1927 the tendency for production to expand was pretty general.

One of the features of the year was the rapidity with which High-Grade zinc leapt into popularity in Europe. Consumers, especially in Central Europe, who could not be persuaded to try 99.9 per cent metal before 1927, are now willing buyers at premiums ranging up to £3 a ton. The insistent demand for High-Grade has indeed been responsible for periodic famines in the available supply, and the new year promises well for the producers of this specification in the United States, Canada, Australia, and Europe.

Estimated stocks on Jan. 1, 1928:

Country	Metric Tons
United States	37,000
Canada	2,400
Australia (including afloat)	2,800
Germany-Poland	6,100
Belgium	4,200
Great Britain	1,100
Scandinavia	200
Far East	600
Elsewhere	1,700
Total	56,100

Amtorg Will Continue to Sell Russian Platinum

A. Linde, director of Edelmetalle Aktion Ges. (Russplatina), of Berlin, the Soviet platinum export organization of which the Amtorg Trading Corporation is the New York representative, has issued the following statement: "Rumors current in trading circles that the Russplatina is conducting negotiations with a group of refiners for the purpose of granting the latter a monopoly on the sale of Russian platinum in the United States have no foundation in fact. I am authorized to state that the sale of Russian platinum on the American market by Russplatina will continue on the same basis as heretofore."

January Dividends Exceed Those for October

MINING company dividends for the month of January exceeded those for October, corresponding month in the preceding quarter, by a good margin. The principal factors in the increase arose through special disbursements—extras or bonuses—paid as year-end dividends. In this class comes the bonus of the Consolidated Mining & Smelting Company of $5 per share in addition to a semi-annual payment of $1.25 per share; a 40c. payment by Tintic Standard, following the regular dividend of 20c., quarterly, paid in December; an extra of $1 by Homestake, over and above the monthly payment of 50c. that has been a regular thing for several years; and an extra of 25c., matching a similar regular dividend, by the New York & Honduras Rosario. Several that pay at semi-annual intervals are also in the January list, whereas they were missing in October. Among these are Mining Corporation of Canada, Arizona Commercial, and Virginia Iron, Coal & Coke. The large increase in the number of outstanding shares of Aluminum Company of America increased the aggregate dividends.

Looking back a year to the list for January, 1927, the present year shows a number that have fallen by the wayside for the time being. Inspiration, Arizona copper producer; Ahumada, lead mine in Chihuahua; Chief Con., which has had numerous setbacks in its lead, zinc, silver, operations in Utah; Gladstone Mountain, high-grade lead property in the State of Washington; and Portland Gold, producer in the Cripple Creek district, were in the list of January, 1927, but cannot be found in that for the current month. Tonopah Mining also seems to be among the casualties. Apparently the reasons for the discontinuance of dividend payments are varied; at least the market condition for any one metal is not an outstanding reason, for those companies that have stopped payments include producers of all of the major non-ferrous metals.

Companies in the United States	Situation	Per Share	Total	Per Cent Annual Yield
Aluminum Co. of America, pfd	Various	$1.50 Q	$2,214,930	5.6
Arizona Commercial, c	Ariz.	0.25SA	66,250	9.1
Bethlehem Steel, pfd	Various	1.75 Q	1,697,500	....
Bunker Hill & Sullivan, l,s	Idaho	0.75 M	243,250	6.0
Cleveland-Cliffs Iron	Mich.	1.00 Q	400,000	3.8
Cresson Consolidated Gold	Colo.	0.10 Q	122,000	20.0
Eagle-Picher Lead, pfd., l,z	Okla., Mo	1.50 Q	12,769	5.1
Homestake Mining, g	S. D.	1.50 MX	376,740	j9.7
Inland Steel, pfd	Minn.	1.75 Q	175,000	....
Kennecott Copper	Alaska	1.25 Q	5,623,022	6.1
Magma Copper, c,s	Ariz.	0.75 Q	306,116	6.0
Newmont Mining, h	Various	1.00 Q	452,760	2.6
Nichols Copper, pfd	N. Y.	1.75 Q	40,247	....
Park Utah Consolidated, s,l,z	Utah	0.20 Q	418,700	6.7
Phelps Dodge, c	Various	1.50 Q	750,000	4.7
Republic Iron & Steel, pfd	Various	1.75 Q	437,500	....
Silver King Coalition, s,l	Utah	0.25 Q	304,025	....
Sloss Sheffield Steel & Iron, pfd	Ala.	1.75 Q	117,250	6.5
Tintic Standard, l,s	Utah	0.40 X	461,166	....
United Gold Mines, g	Colo.	0.01	48,017	....
U. S. Smelting, Refining & Mining, s,l	Various	0.875Q	306,350	8.3
U. S. Smelting, Refining & Mining, pfd	Various	0.875 Q	425,557	6.7
Virginia I. C. & C., pfd	Various	2.50SA	125,000	....
Companies in other countries:				
Asbestos Corporation, pfd	Quebec	1.75 Q	130,482	7.5
Consolidated M. & S., l,z,s	B. C.	6.25 SAB	3,178,481	....
Dome Mines, g	Ont.	0.25 Q	238,333	8.0
Erupcion, l,s	Chihuahua	0.075 Q	93,750	....
Frontino & Bolivia, g	Colombia	1s.	£7,000	....
Hollinger Consolidated Gold	Ont.	0.10 4 wks	492,000	6.8
Howe Sound, s,c,l	B. C., Mex.	1.00 Q	496,038	9.2
Lucky Tiger-Combination, g,s	Sonora	0.05M	35,767	....
Mining Corp. of Canada, s	Ont.	0.125 SA	207,560	....
Nipissing, s	Ont.	0.075 Q	90,000	5.4
Patino Mines & Ent., t	Bolivia	4s.	£276,063	....
Premier Gold, s,g	B. C.	0.08 Q	$400,000	10.6
San Francisco Mines of Mexico, l.,s	Chihuahua	2s. 6d	£187,994	....
Santa Gertrudis, s,g	Hidalgo	1s. 6d	£105,505	....
Total			$20,486,560	

s, silver; l, lead; z, zinc; g, gold; c, copper; h, holding; Q, quarterly; M, monthly; X, extra; QX, $0.25 regular and $0.25 extra; SA, semi-annually; SAB, semi-annual, $1.25, bonus $5; MX, monthly 50c., extra $;1 I, irregular; j, based on dividends for the last twelve months.

The Market Report

Metal Prices Slightly Higher in Firm But Quiet Market

New York, Jan. 25, 1928—The prices of copper, lead, zinc, and tin are all slightly higher than a week ago, though the market has not been active. The strength has resulted from increased disinclination by producers to sell, rather than to a good consuming demand. It is felt that buying of most metals is likely to improve within a week or two; in fact, it has been materially better this last week abroad. Silver is practically unchanged, as are the minor metals. Steel prices have advanced slightly for some forms.

Daily Prices of Metals

Jan.	Copper	Tin		Lead		Zinc
	Electrolytic, N. Y.	99 Per Cent	Straits	N. Y.	St. L.	St. L.
19	13.825	54.00	54.50	6.50	6.25@6.30	5.60@5.625
20	13.825	54.625	55.00	6.50	6.25@6.275	5.625
21	13.825	55.00	55.375	6.50	6.25@6.275	5.625
23	13.825	55.375	55.75	6.50	6.275	5.625@5.65
24	13.90	55.00	55.375	6.50	6.275	5.65
25	13.90	55.00	55.375	6.50	6.275@6.30	5.65
	13.850	54.833	55.229	6.500	6.273	5.633

Average prices for calendar week ending Jan. 21, 1928, are: Copper, 13.804, 99 per cent tin, 54.333; Straits, 54.750; N. Y. lead, 6.500; St. Louis lead, 6.271; zinc, 5.619; and silver, 56.854.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; i.e., delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for ordinary form of wire bars, ingot bars, and cakes. For ingots an extra 0.05c. per pound is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.13c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Jan.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
19	61 3/8	61 1/4	66 1/2	248 7/8	247 5/8	21 3/4	22 1/4	26 1/8	26 1/16
20	61 3/4	61 5/8	66 1/2	250	248 5/8	21 3/4	22 1/4	26 3/16	26 1/8
23	62 3/16	61 15/16	66 1/2	253 7/8	252 3/8	21 13/16	22 3/16	26 1/4	26 1/8
24	62 13/16	62 9/16	66 1/2	251 3/4	250 1/4	21 7/8	22 3/16	26 1/4	26 3/16
25	63 1/16	62 9/16	66 3/4	252 5/8	250 3/4	21 3/4	22 3/16	26 3/8	26 1/4

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Jan.	Sterling Exchange "Checks"	Silver		Gold London	Jan.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
19	4.87 1/8	56 1/2	26 1/16	84s11 1/4d	23	4.86 7/8	56 5/8	26 3/16	84s11 1/4d
20	4.87	56 3/4	26 1/8	84s11 1/4d	24	4.87	56 1/2	26 1/16	84s11 1/2d
21	4.86 15/16	56 7/8	26 1/4	.....	25	4.87	56 5/8	26 3/16	84s11 1/2d
					Avg.		56.646		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths of a cent premium.

Good Export Demand for Copper

Excellent sales in the export market during the last two or three days have been a marked influence in removing the pressure to sell on the part of the custom smelters. The copper that was available from such sources until Monday at 14c. for Eastern deliveries is no longer obtainable, and all sales yesterday and today have been on the 14⅛c., Valley, basis. From Thursday to Monday inclusive, the larger lots were sold at or near the 14c. level in the East and 14.20c. in the Middle West, with occasional sales up to the 14⅛c. level, at which some special lots were purchased. The market today has not been active, and it was intimated by one seller that 14⅛c. was unobtainable, but until actual business is accepted at lower figures the market must be considered at least as fairly firm at that level. Certainly it is a firm quotation as far as the major producers are concerned, and has been all week. Whether there will be any renewed concessions on the part of the custom smelters depends on the continuance of foreign buying or the resumption of interest by domestic consumers. Total sales for the week, as may be gathered from the above remarks, are somewhat below normal, but with light buying ever since the first week in December, and satisfactory consumption in most lines, another buying movement seems due.

Foreign prices continue unchanged at 14½c., c.i.f., and from 14.25@14.35c., f.a.s.

Lead Situation Unchanged

Prices for lead, not only in New York and St. Louis but in London, are virtually unchanged from a week ago. Domestic business has been in moderate volume, with inquiry fair to good all week. The second-hand lead that was available in the Middle West a week ago at 6.25c. appears to have found a buyer, and 6.275c. is the lowest price for any reasonable tonnage since Monday. On the other hand, sales at 6.30c. have been few and small, the preponderant tonnage having been placed on the basis of the average prices quoted in *Engineering and Mining Journal*. Several lots in Chicago brought 6.33c. The American Smelting & Refining Company has maintained its contract price in New York at 6.50c., and, with the exception of one or two small transactions, the "outside" market has been firm at this level. Most of the business is for prompt delivery, although some deliveries for March and even April—contrary to the usual custom of sellers—have been specified. Cable makers and manufacturers of "blue-lead" products have been more in evidence as buyers than have paint and storage-battery makers.

Zinc Market Neglected

Sales of zinc, like those of copper, have been well below normal, with about 2½ points difference between sellers' and buyers' ideas of the market. Judging by

the gradual advance in the price, from 5.60 to 5.65c., sellers apparently have had more ground for their belief than buyers. Business is reported good in England, and the London prices are up from 5 to 7½s. from a week ago. Ore buyers in the Tri-State district have not been able to get as much ore as desired at the current price, and a slight advance is not unlikely. This, in turn, would make the smelters even less disposed to accept the offerings that galvanizers are making at present. Today, some quotations have been made as high as 5.675c., though that price cannot be said to have been established. Prompt metal is somewhat easier than forward.

Little Activity in Domestic Tin

The tin market is dominated by buyers rather than sellers. Recent reports of exceptionally small shipments from the Straits, which a year ago would have caused a sharp advance in London, had only a slightly bullish effect on the other side, and in the domestic market almost no effect at all. In spite of the fact that the current prices are about 13c. under those of January, 1927, and 10c. under the average for the entire year, consumers are not satisfied to consider it "cheap." They may be wrong, but they feel they can afford to take the chance. Consumption in the automobile industry and by the tin-plate interests has picked up materially, but at the same time there is every evidence of a higher production rate in the Far East, so that the relative position is little changed. Tin of 99 per cent grade brings within ½c. of Straits.

Silver Closes at 56⅝c.

The silver market during the last week has fluctuated within narrow limits and continues quiet and inactive. The tendency appears steady, with a moderate buying movement and lack of pressure to sell.

Mexican Dollars (old Mexican pesos): Jan. 19th, 43⅜c.; 20th, 43⅜c.; 21st, 43½c.; 23d, 43¼c.; 24th, 43⅜c.; 25th, 43¼c.

Foreign Exchange

No significant changes have occurred in the foreign money markets. Closing cable quotations on Tuesday, Jan. 24, were as follows: Francs, 3.93 7/16c.; lire, 5.29¼c.; and marks, 23.84c. Canadian dollars, ⅛ per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

ALUMINUM—Per lb., 98 or 99 per cent grade, price of leading interest, 24.30c.; outside market, 23.90@24.30c.

ANTIMONY—Per lb., duty paid. New York: Chinese brands, spot business, range for the week 10¾@10⅞c. Forward positions through March about ⅛c. higher.

Cookson's "C" grade, spot, 16⅜c. Needle antimony nominally 8c. for lump and 10c. for powdered. White oxide, Chinese, 99 per cent Sb_2O_3, 15½c.

BISMUTH—Per lb., New York, in ton lots, $1.85@$2.10.

IRIDIUM — Per oz., $425@$450 for 98@99 per cent sponge and powder. Strong market; shortage of supply.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 37c. (99.9 per cent grade) for single lots of spot metal. Contracts for 1928 have recently been made at 30@33c. per lb. for ingot, depending upon quantity; and at 34½@35c. per lb. for electrolytic.

PALLADIUM — Per oz., $51@$53. Small lots bring up to $56.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $85. Dealers and refiners quote the trade for refined metal, per oz., cash, $83@$85. Market moderately active at higher prices.

QUICKSILVER—Per 76-lb. flask, $122 @$124, depending on quantity. Market very quiet. San Francisco wires $127.67.

RHODIUM—Per oz., $60@$65.

RUTHENIUM — Per oz., $65@$70. Market strong.

Prices of Cadmium, Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Jan. 7.

Metallic Ores

MANGANESE ORE—Per long ton unit of Mn. c.i.f. North Atlantic ports, minimum 47 per cent Mn; 35@38c. Caucasian, washed, 53@55 per cent, 38.50@ 40c. Chemical grades unchanged from quotations in the Jan. 7 issue.

TUNGSTEN ORE—Per unit of WO_3, N. Y.; Wolframite, $10.25@$10.50. Western scheelite, $10.50@$10.75. Market dull, but asking price steady.

Chrome, Iron, Tantalum, and Titanium ores are unchanged from quotations in the Jan. 7 issue.

Tri-State Ore Prices Unchanged

Joplin, Mo., Jan. 21, 1928

Blende	Per Ton
Hight	$39.90
Premium blende, basis 60 per cent zinc	$37.00@ 39.00
Prime Western, basis 60 per cent zinc	36.00@ 37.00
Slimes and fines, 60 per cent zinc	33.00@ 36.00
Average settling price, all zinc	37.23
Galena	
High	$87.80
Basis 80 per cent lead	$85.00@ 87.50
Average settling price, all lead	86.86

Shipments for the week: Blende, 9,390; lead, 2,503 tons. Value all ores the week, $564,500.

Shipments for ten consecutive weeks having been short of smelters' estimated requirements leaves an impression with sellers that smeltermen are about 25,000 to 30,000 tons short in stocks of zinc concentrate at the smelters. This is taken to suggest that buyers must increase purchases or start closing down a large number of retorts, either of which will benefit the local situation. Lead ore was more freely sold. Although buyers cling to the statement that the basis is $85, settlement prices suggest a higher basis.

Platteville, Wis., Jan. 21, 1928

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$38.15
Lead Ore	
Lead, basis 80 per cent lead	$85.00

Shipments for the week: Blende, 806 tons; lead, 120 tons. Shipments for the year: Blende, 2,058; lead, 160 tons. Shipments for the week to separating plants, 1,243 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the Jan. 7 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic) —Per lb., 4c. Market slack.

Calcium Molybdate, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the Jan. 7 issue.

Ferro-Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or c.i.f. port of entry, $100 quoted for first quarter, 1928. Spiegeleisen, 19@21 per cent, $31@$32 f.o.b. furnace.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent, 92@94c. f.o.b. works. Dullness expected for several months.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, and Ferrovanadium are unchanged from prices in the Jan. 7 issue.

Metal Products

Rolled copper, lead sheets, nickel silver, yellow metal and zinc sheets are unchanged from price in Jan. 7 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the Jan. 7 issue.

Iron, Steel, and Coke

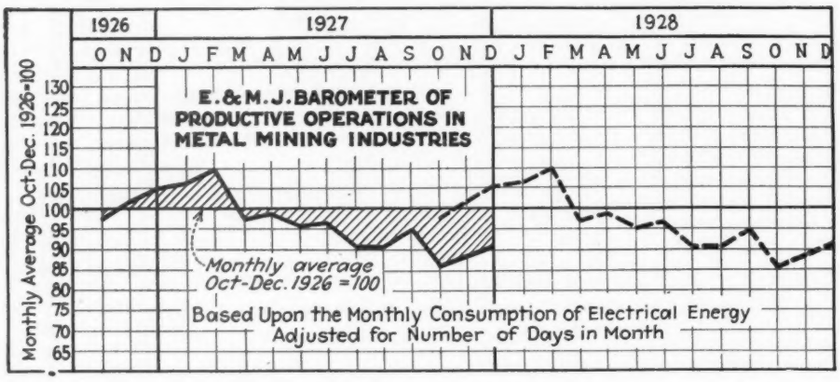
Iron—Per gross ton, Valley furnaces, Bessemer, $17.50; basic, $17; No. 2 foundry, $17.25.

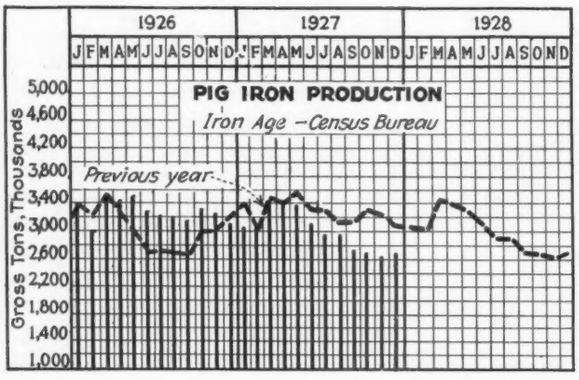
Steel—Base prices per gross ton, Pittsburgh, billets and slabs, $33; plates, structural shapes, and soft steel bars, per pound, 1.80c.@1.85c.

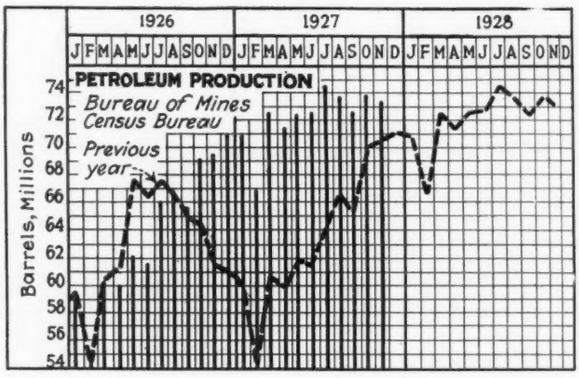
Coke—Per gross ton, Connellsville furnace, contract, $2.85@$3; spot, $2.60 @$2.75. Connellsville foundry, contract, $3.75@$4.25; spot, $3.75@$4.25. By-product coke, Ohio and Kentucky, $7.50; Buffalo and Detroit, $9.

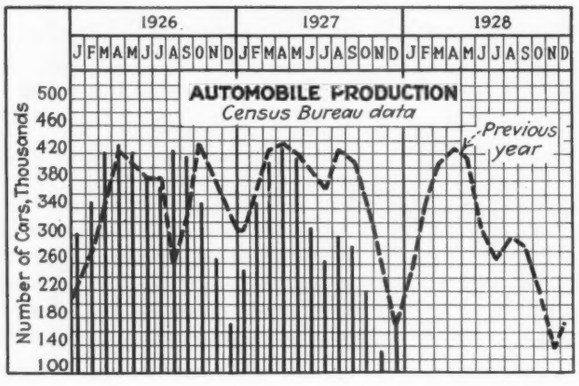
Indicators of Industrial Activity

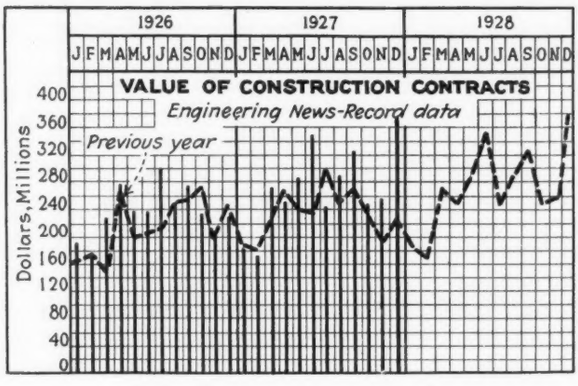
of Significance to Mining

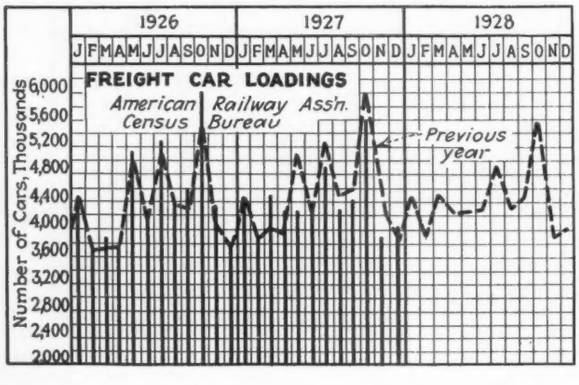

1926
1927
1928
O N D J F M A M J J A S O N D J F M A M J J A S O N D
Monthly Average Oct-Dec. 1926=100
130 125 120 115 110 105 100 95 90 85 80 75 70 65
E. & M. J. BAROMETER OF PRODUCTIVE OPERATIONS IN METAL MINING INDUSTRIES
Monthly average Oct-Dec. 1926 = 100
Based Upon the Monthly Consumption of Electrical Energy Adjusted for Number of Days in Month

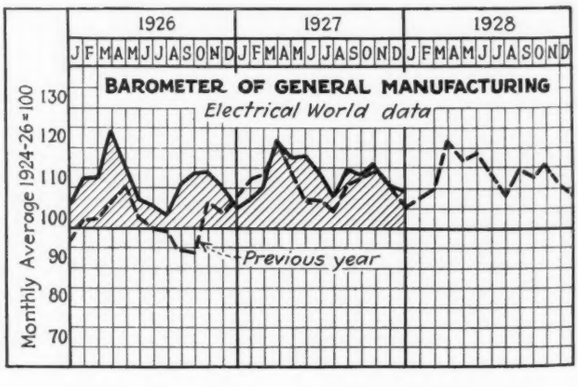

1926
1927
1928
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
Gross Tons, Thousands
5,000 4,600 4,200 3,800 3,400 3,000 2,600 2,200 1,800 1,400 1,000
PIG IRON PRODUCTION
Iron Age — Census Bureau
Previous year


1926
1927
1928
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
Barrels, Millions
74 72 70 68 66 64 62 60 58 56 54
PETROLEUM PRODUCTION
Bureau of Mines
Census Bureau
Previous year


1926
1927
1928
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
Number of Cars, Thousands
500 460 420 380 340 300 260 220 180 140 100
AUTOMOBILE PRODUCTION
Census Bureau data
Previous year


1926
1927
1928
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
Dollars, Millions
400 360 320 280 240 200 160 120 80 40 0
VALUE OF CONSTRUCTION CONTRACTS
Engineering News-Record data
Previous year


1926
1927
1928
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
Number of Cars, Thousands
6,000 5,600 5,200 4,800 4,400 4,000 3,600 3,200 2,800 2,400 2,000
FREIGHT CAR LOADINGS
American Railway Ass'n. Census Bureau
Previous year


1926
1927
1928
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
Monthly Average 1924-26=100
130 120 110 100 90 80 70
BAROMETER OF GENERAL MANUFACTURING
Electrical World data
Previous year

Mining Stocks—Weeks Ending Jan. 14 and Jan. 21, 1928

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	58	53⅜	55⅛	Ja.14, Fe.20 Q	0.75
Arcadian Consol.	Boston	3⅜	3	3⅜		
Ariz. Com'l	Boston	6	5⅛	5⅛	Ja. 19, Ja. 31	0.25
Calumet & Arizona	New York	112	101½	106½	De. 3, De. 9 Q	1.50
Calumet & Hecla	Boston	21⅞	20⅛	21⅛	No.30, De.15 Q	0.50
Cerro de Pasco	New York	68	66	67⅛	Ja.12, Fe.8 Q	1.00
Chile Copper	New York	42⅜	40	40⅛	Fe. 28, Ma. 15Q	0.50
Con. Coppermines	N. Y. Curb	6⅛	5	5⅛		
Copper Range	Boston	19¼	17⅛	18	Ap.2, My.2, A	1.00
Crystal Copper	Bos tonCurb	*78	*62	*70		
East Butte	Boston	2⅛	1⅛	1⅛	Dec. 1919	0.50
Granby Consol	New York	42⅛	39⅛	40⅛	Ja.15 Jy. 1 Q	1.00
Greene Cananea	New York	144⅛	124	134⅛	Nov., 1920	0.50
Howe Sound	New York	44⅛	42	43	De.31, Ja.16, Q	1.00
Inspiration Consol	New York	20	18⅛	19	Ma.17, Ap.4, Q	0.25
Iron Cap	Boston Curb	2⅜	2⅛	2⅛		
Isle Royale	Boston	14⅛	13	13⅜	Fe. 28, Ma. 15	0.50
Kennecott	New York	84⅜	80⅜	82	De. 2, Ja 3 Q	1.25
Magma Copper	New York	53⅛	49⅜	50⅜	De.30, Ja.17 Q	0.75
Mason Valley	N. Y. Curb	1⅜	1⅛	1⅛		
Miami Copper	New York	19⅛	18⅛	18⅜	Fe.1, Fe.15, Q	0.37½
Mohawk	Boston	49⅛	47⅛	48	Ja. 28, Ma. 1 Q	1.00
Montana-Idaho	Spokane	*46½	*43½	*46½		
Mother Lode Coal	New York	3	2⅜	2⅜	De.16, De.31	0.25
Nevada Consol	New York	18⅜	17⅛	17⅛	De.16, De 31 Q	0.37½
New Cornelia	Boston	28	26	27⅛	Fe. 3, Fe. 20 Q	0.50
Noranda	N. Y. Curb	22⅜	20⅜	20⅜		
North Butte	Boston	1⅛	*95	1⅛	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	1.00	*91	1.00	Sept. 1926	0.03
Old Dominion	Boston	11⅛	11	11⅛	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	129½	125	126	De.17, Ja.3 Q	1.50
Quincy	Boston	14½	14	14	March, 1920	1.00
St. Mary's Min. Ld.	Boston	31	28	29⅜	Fe.10, Ma.10	2.00
Seneca Copper	New York	2⅜	2	2⅛		
Shattuck-Denn	Boston Curb	10⅛	8	9⅛		
Tenn. C. & C.	New York	11⅛	10⅛	10⅜	No.30, De.15, Q	0.12½
United Verde Ex	N. Y. Curb	25	23⅛	25	Ja.4, Fe.1 Q	0.50
Utah Copper	New York	1.51	1.39	1.45	De.16, De.31 Q	1.50
Utah Metal & T	Boston	1⅛	1⅛	1⅛	Dec., 1917	0.30
Walker Mining	Salt Lake	*66	*53	*65		
NICKEL-COPPER						
Internat. Nickel	New York	95⅜	87⅛	92⅜	De.16, De.31 Q	0.50
Internat. Nickel pfd.	New York	...	...	110⅛	Fe. 17, Ma. 1 Q	0.62½
LEAD						
Gladstone Mtn	Spokane	*16½	*12	*13⅜	June, 1927	0.005
National Lead	New York	134	126	127	De. 16, De. 31 Q	1.25
National Lead pfd	New York	129	113	127	Ma. 2, Ma. 15Q	1.75
St. Joseph Lead	New York	43¼	41⅛	41⅞	Ma.9, Ma.20, QX	0.75
ZINC						
Am. Z. L. & S.	New York	7⅛	6⅞	7	May, 1917	1.00
Am. Z. L. & S. pfd.	New York	45⅛	40	44⅜	Nov., 1920	1.50
Butte C. & Z.	New York	4⅛	4⅛	4⅜	De. 9, De. 24	0.50
Butte & Superior	New York	9⅛	9	9⅛	De.16, De.31 Q	0.50
Callahan Zn-Ld	New York	2⅛	2	2⅛	Dec., 1920	0.50
Consol.Lead&Zinc'A'	St. Louis	15	14	14	Ma.15, Ap.1 Q	0.25
Eagle-Picher	Cincinnati	24	21⅞	22⅞	No.15, De.1 Q	0.40
Eagle-Picher pfd	Cincinnati	117½	117½	117½	Ja.30, Oc.15 Q	1.50
New Jersey Zn	N. Y. Curb	185¼	180⅛	184	Ja. 20, Fe. 10	2.00
United Zinc	N. Y. Curb	...	...	25		
Yellow Pine	Los Angeles	*40	*25	*30	Dec. 1925 Q	0.04
GOLD						
Alaska Juneau	New York	2⅛	1⅞	2⅛		
Argonaut	Toronto	*3⅛	*26	*26		
Barry-Hollinger	Toronto	1.11	1.00	1.02		
Central Manitoba	Toronto	3.45	3.42	3.45		
Con.W.Dome L.new.	Toronto	*16⅛	*13	*15		
Cresson Consol. G	N. Y. Curb	2⅛	1⅞	2⅛	De. 31, Ja.10 Q	0.10
Dome Mines	New York	13	12⅛	12⅛	Ma. 31, Ap. 20Q	0.25
Golden Cycle	Colo.Springs	†1.74½	†1.73	...	No.30, De.10 Q	0.04
Gold Hill	Toronto	*34	*33	*34		
Hollinger Consol	Toronto	18.00	17.70	17.75	Ja.1, Ja.27 M	0.10
Homestake Mining	New York	74⅛	72	72	Ja.20, Ja.27 MX	1.50
Kirkland Lake	Toronto	2.61	2.35	2.37		
Lake Shore	Toronto	27.00	25.70	25.85	De.1, De.15 QX	0.20
McIntyre-Porcupine	New York	27⅜	26⅞	27⅛	Fe. 1, Ma. 1 Q	0.25
Portland	Colo.Springs	†*25	†*18	...	Ap.6, Ap.15, Q	0.02
Rand Mines	New York	45	42	43⅛	Au.22-29 Am.Sh.	1.52
Sylvanite	Toronto	1.80	1.76	1.80		
Teck-Hughes	Toronto	10.40	9.60	9.70	Fe.1, X	0.15
Tom Reed	Los Angeles	*38	*34	*36	Dec., 1926	0.02
Tough-Oakes	Toronto	*76	*64	*70		
United Eastern	N. Y. Curb	*70	*51	*57	July, 1924	0.05
Vipond Cons	Toronto	*79	*64	*68	Apr.1, Apr.15	0.03
Wright-Hargreaves	Toronto	6.30	5.50	5.98	Ja. 11, Fe. 1	0.05
GOLD AND SILVER						
Carnegie Metals	Pittsburgh	24⅛	17	22		
Con. Cortez	N. Y. Curb	...	...	*18		
Dolores Esperanza	N. Y. Curb	*50	*50	*50	July, 1923	0.05
Premier Gold	N. Y. Curb	3⅛	2⅛	3	De.15, Ja. 4	0.08
Tonopah Belmont	N. Y. Curb	2⅛	1⅞	1⅞	Ma.15, Ap.4	0.08
Tonopah Extension	N. Y. Curb	*18	*13	*13	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	4⅛	2⅛	3⅛	Se.20, Oc.21	0.07½
West End Consol	N. Y. Curb	*6	*5	*5	Mar., 1923	0.05
Yukon Gold	Boston Curb	*70	*60	*63	June, 1918	0.02
SILVER						
Beaver Consol	Toronto	2.15	1.92	1.96	May, 1920	0.03
Castle-Trethewey	Toronto	*76	*70	*70		
Coniagas	Toronto	5.00	4.80	4.80	May, 1924	0.12½
Keeley	Toronto	*72	*65	*65	Se.1, Se.15	0.08
Lorrain Trout Lake	Toronto	...	...	*60	July, 1925	0.05
Mining Corp. Can	Toronto	5.50	4.05	5.30	Ja. 10, Ja. 25	1.50
Nipissing	N. Y. Curb	5⅛	5⅛	5⅛	De. 31, Ja.20 Q	0.07½

Stock	Exch.	High	Low	Last		Last Div
SILVER-LEAD						
Ahumada	New York	4	2⅛	3⅛	Ma. 25, Ap.4, QX	0.12½
Bingham Mines	Boston	56	54	54	Ja. 21, Fe. 1 Q	0.95
BunkerHill&Sullivan	N. Y. Curb	150	141	150	De. 31, Ja. 4 X	0.75
Cardiff M. & M.	Salt Lake	*91	*88	*90	Feb 5, 1927	0.10
Chief Consol	Salt Lake	3.65	3.22½	3.40	Ja.10, Fe.1 Q	0.10
Consti'nMng.&Mill'g	Spokane	*28	*24	*25		
Erupcion	Boston Curb	*50	*20	*45	De.17, Ja.3 Q	0.07½
Eureka Lily	Salt Lake	1.95	1.70	1.82½		
Federal M. & S.	New York	...	...	147½	Jn.25, Jn.29 Spec.	$10
Federal M. & S pfd.	New York	93⅛	93	93	No. 12 De 15 Q	0.25
Hecla Mining	N. Y. Curb	18	16⅛	17⅜	No.15, De.15 Q	1.75
Highland-Surprise	Spokane	*15⅛	*14½	*14½		
Iron King Mining	Salt Lake	*72	*57	*60		
Keystone Mining	Salt Lake	*27	*27	*27	Au. 12, Au. 26	0.07½
Lucky Jim	Spokane	*38½	*30	*37		
Lucky Tiger-Com	Kansas City	†8.00	†7.85	...	De.10, De. 20 X	0.12
Mammoth Mining	Salt Lake	2.50	2.40	2.40	Jn.10, Jn.20 Q	0.05
North Lily	Salt Lake	4.00	3.70	3.90		
Park Utah	New York	13⅜	11⅛	12	De. 15, Ja. 3 Q	0.20
Plutus Mining	Salt Lake	2.40	2.40	2.40	Oc. 25, No. 10 Q	0.10
Silver King Coal	Salt Lake	12.50	10.00	11.25	De. 24, Ja.2 X	0.35
Silversmith	Spokane	*30	*19½	*28	Oct., 1926 Q	0.02
Strattons Mines	Spokane	*48½	*44	*47		
Sunshine M. Co.	Spokane	1.48	1.40	1.45		
Tamarack-Custer	Spokane	*82	*70	*82	Sept., 1924	0.25
Tintic Standard	Salt Lake	16.50	13.75	14.25	De.20, Ja.3 QX	0.40
Utah-Apex	Boston	5	4⅛	4⅛	Oct., 1926	0.25
IRON						
Bethlehem Steel	New York	58⅛	55⅛	57⅛	Se. 2, Oc. 1	1.75
Cleveland-Cliffs Iron	Cleveland	106	102	105	Ja.13, Ja.25 Q	1.00
Colorado Fuel & Iron	New York	80⅛	76	78	May, 1921	0.75
Gt. North'n Iron Ore	New York	96⅛	93⅛	96	Dec. 6, Dec. 28	0.75
Inland Steel	New York	60	57	58⅛	No. 15, De. 1 Q	0.62½
Replogle Steel	New York	...	...	12⅛		
Republic I. & S.	New York	65⅛	59	59⅛	Fe. 15, Ma. 1 Q	1.00
Republic I. & S. pfd.	New York	106⅛	105⅛	106	Ma. 15, Ap. 2 Q	1.75
Sloss-Sheffield S. & I.	New York	126	121	126	De. 10, De. 20 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	...	...	110	De. 20, Ja.3 Q	1.75
U. S. Steel	New York	150⅛	143⅛	147⅛	No. 30, De. 30 Q	1.75
U. S. Steel, pfd.	New York	140	138⅛	139⅛	Oc.30, No. 29 Q	1.75
Virginia I. C. & C.	New York	38	38	38	Jan., 1924	1.50
Virginia I.C.&C. pfd.	New York	62⅛	62⅛	62⅛	De. 16, Ja. 3	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York	...	...	24	Jn. 26, Jn.30	1.45
So. Am. G. & P. New.	N. Y. Curb	3⅛	2⅛	3		
Alum. Co. of Amer	N. Y. Curb	124	120	123		
Alum. Co. ofAmer.pf.	N. Y. Curb	106⅛	105⅛	106⅛	De. 15, Ja1 Q	1.50
Vanadium Corp.	New York	68⅛	60	68⅛	Fe. 1, Fe. 15 Q	0.75
Patino M. & E.	New York	25⅜	23⅛	25⅛	De 31, Ja. 14	4s.
ASBESTOS						
Asbestos Corp.	Montreal	34⅛	33	33	Jan., 1926	1.50
Asbestos Corp. pfd.	Montreal	94	92	93	De.31, Ja.16 Q	1.75
SULPHUR						
Freeport Texas	New York	109⅛	102	104⅛	Ja.14, Fe.1 QX	1.75
Texas Gulf	New York	78⅛	73⅛	76⅛	De. 1, De. 15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	45⅞	42	44⅛	No.19, De.1 Q	0.75
Amer. Metal, pfd.	New York	116	110⅛	111⅛	No.19, De.1 Q	1.75
Amer. Sm. & Ref.	New York	180⅛	172⅛	175⅛	De.31, Fe. 1 Q	2.00
Amer. Sm. & Ref. pfd.	New York	134	131⅛	134	De.31, Ma.1 Q	1.75
Consol. M. & S.	Montreal	263	251	263	De. 31, Ja. 16 X	6.25
Newmont Mining	N. Y. Curb	159	122	154	Ja.3, Ja. 17	1.00
U. S. Sm. R. & M.	New York	43⅛	40⅛	42⅛	Ja. 6, Ja. 14 Q	0.87½
U.S. Sm. R.&M. pfd.	New York	53	52	52⅛	Ja. 6, .33 14 Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEKS ENDED JAN. 3 & 10, 1928

Name	High	Low	Last	Date	Amount	Last Div.
Aramayo Mines (25 frs.)	73/—	72/9	75/—	Nov., 1927	5 p.c.	(†)
British Platinum (£1)	—/3	—/3	—/3	Feb., 1925	2½ p.c.	
Burma Corpn. (10 rupees)	14/4½	13/9	14/1½	Jan., 1928	6 annas*	
Bwana M'Kubwa (5s)	4/7½	3/10½	4/6			
Camp Bird (2s)	3/3	2/6	3/3			
El Oro (£1)	3/3	2/9	3/1½	Nov., 1924	2½ p.c.*	
Esperanza (10s)	—/3	—/1½	—/1½			
Frontino & Bolivia (£1)	14/4½	13/3	13/9	Jan., 1928	5 p.c.	
Mexican Corpn. (£1)	9/4½	8/—	9/—			
Mexico Mines of El Oro (£1)	18/9	15/—	17/6	Dec., 1926	3½ p.c.*	
N'Changa Copper Mining	12/—	8/—	12/—			
Oroville Dredging (£1)	4/3	3/10½	4/—	Dec., 1923	3½ p.c.	
Ouro Preto (£1)	2/6	2/—	2/3	May, 1925	2½ p.c.	
Rhodesian Congo Border (£1)	31/3	25/7½	28/9			
St. John del Rey (£1)	10/6	9/9	10/—	May, 1927	3½ p.c	
San Francisco Mines (10s)	29/1½	28/1½	28/3	Jan, 1928	25s.	
Santa Gertrudis (£1)	17/—	16/6	16/9	Jan., 1928	7½ p.c	
Selukwe (2s. 6d.)	8/6	7/7½	8/—	April, 1917	6½ p.c	
S. Amer. Copper (2s.)	—/10½	—/4½	—/7½	Nov., 1917	7½ p.c	
Tanganyika (£1)	73/10½	66/6	70/—	Aug., 1927	7½ p.c	
Union Miniere du Haut-Katanga (Brussels)	13.700	11.375	12.675	July, 1927	182.60f(‡)	

* Free of British income tax. † Swiss francs and plus 15 p. c. bonus. ‡ Belgian frs. and free of taxation.

Current Prices of Mining Supplies

Rise and Fall of the Market

STEEL structurals are $1.85 per 100 lb., f.o.b., Pittsburgh, against $1.80 last month. Sheets also rose about 5c. per 100 lb. Fir and hemlock timbers sell above December levels; pine is lower. Smaller discounts obtain on hose and belting at warehouses. The declines, mostly seasonal, occurred in railroad spikes, fish plates ,cast-iron pipe, wire nails, lime, linseed oil, and flotation oil.

SHEETS—Quotations are per 100 lb. in various cities from warehouse, also the base quotations from mill:

	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
Galvanized No. 24	$3.65@$3.75	$5.25	$4.80	$5.35	$4.95

STEEL RAILS—The following quotations are per gross ton f.o.b. Pittsburgh, Chicago and Birmingham for carload or larger lots:

	Pittsburgh—Current	Pittsburgh—One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00
Standard openhearth rails	43.00	43.00	43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh or carload lots, together with the warehouse prices at the places named:

	Pittsburgh—Current	Pittsburgh—One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	$2.70@$2.80	$2.80–$2.90	$3.55	$3.65	$3.85	$3.00
Track bolts	3.80	3.90@4.25	4.55	4.65	5.35	3.90
Standard section angle bars, splice bars or fish plates	2.75	2.85	3.40	4.25	4.25	2.95

STRUCTURAL MATERIAL—Following are base prices per 100 lb. in carload lots, f.o.b. Pittsburgh mill, and Birmingham. At other cities listed, quotations apply on less-than-carload lots, from warehouses.:

	Pittsburgh, Mill	Birmingham	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.85	$1.90@$2.00	$3.34	$4.00	$3.25	$3.10	$3.15
Channel, 3 to 15 in.	1.85	1.90@ 2.00	3.34	4.00	3.25	3.10	3.15
Angles, 3 to 6 in., ¼ in. thick	1.85	1.90@ 2.00	3.34	4.00	3.25	3.10	3.15
Tees, 3 in. and larger	1.85	1.90@ 2.00	3.34	4.00	3.35	3.10	3.15
Plates ¼-inch thick	1.85	1.90@ 2.00	3.34	4.00	3.25	3.10	3.15

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5%
Plow steel round strand rope	35%
Special steel round strand rope	30%
Galvanized iron rigging and guy rope (*add to list*)	12½%

	New York	Cleveland	Chicago
DRILL ROD (from list)	60%	55%	50%

WROUGHT IRON AND STEEL PIPE—The following discounts from list are to jobbers for carload lots at Pittsburgh mill:

	Steel Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
BUTT WELD—	⅛ to 3	62	50½	⅛ to 1½	30	13
LAP WELD—	2½ to 6	59	47½	3 to 6	28	13

WROUGHT-STEEL PIPE—From warehouses at the places named the following discounts from list hold for steel pipe:

	Black—New York	Black—Chicago	Black—St. Louis
2½ to 6 in., lap welded	48%	51%	46%

CAST-IRON PIPE—The following are prices on class B and heavier, f. o. b. per net ton, for carload lots:

	New York—Current	New York—One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$37.60	$48.60	$27.50	$35.70	$33.10	$38.00

NUTS—Hot pressed or cold punched, square or hexagonal, blank or tapped, up to 1-in., inclusive, full kegs or cases, discount 55% from new list, April 1, 1927, at warehouses in New York and vicinity.

HOLLOW TILE—Price per block in carload lots, f.o.b., to contractors, for hollow building and partition tile.

	New York—Current on Trucks‡	New York—One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco‡	Perth Amboy N. J., Factory
4x12x12	$0.0966	$0.1027	$0.076	$0.105	$0.068	$0.108	...
6x12x12	.145	.1541	.104	...	.09	.156	$0.2432*
8x12x12	.1812	.1926	.142	.21	.126	.244	.3311†

* 10x12x12; † 12x12x12. ‡ Partition tile

MACHINE BOLTS—Square heads and nuts, up to 1x30-in., full kegs or case discount 50% from new list, April 1. 1927 at warehouses in New York and vicinity.

LUMBER—Prices wholesale, per M ft. b.m., in carload lots, f.o.b. San Francisco—At yards, rough Douglas fir, No. 1 common:

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft
3x3 and 4	$29.00	$30.00	$31.00	$34.00
3x6 and 8	29.00	30.00	31.00	34.00
4x4-6 and 8	29.00	30.00	31.00	34.00

New York—Prices are for long-leaf yellow pine timbers (rough) to dealers alongside dock. Price to contractors, delivered to job, is $5@$10 additional:

	New York—20 Ft. and Under	New York—22-24 Ft.	Chicago—Up to 20 Ft., Pine	Chicago—Up to 32 Ft., Fir*
3x4 to 8x8	$41.00@43.00	$42.00@44.00	$37.00	$39.50
3x10 to 10x10	48.00@50.00	49.00@51.00	45.00	39.50
3x12 to 12x12	55.00@57.00	56.00@58.00	55.00	39.50

Other Cities—Prices are for rough timbers:

	8 x8-In. x 20 Ft. and Under—Pine	Fir*	Hemlock	Spruce	12 x 12-In ‡ 20 Ft. and Under—Pine	Fir*
Boston	$48.00	$47.50†	$49.00	$52.00	$57.50	$57.00
Cincinnati	33.00	46.00	44.00	44.00	37.00	50.00
Denver	.....	32.75	32.75	32.75	33.75	33.75
Minneapolis	42.50	37.75	38.50	.....	47.00	38.75
Kansas City, Mo.	40.50	39.25	.....	.....	54.50	39.75
Philadelphia	48.00	35.00	40.00	45.00	60.00	35.00

*Douglas fir. †Prime. ‡3x12 to 12x12 Chicago S4S.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.45@2.55	$2.95	$3.25	$4.25	$2.83	$4.95
Cut	2.80	....	4.90	5.00	2.88	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without charge for bags.* Cash discount not deducted.

	Current	One Month Ago	One Year Ago
New York, del. by truck	$2.25@2.35	$2.35	$2.50@2.60
Chicago, f.o.b.	2.05	2.05	2.10
Cleveland, f.o.b.	2.24	2.24	2.29

LIME—Warehouse; New York quotes bbl. 280 lb. net; Chicago, 180 lb.:

	Hydrated, per Ton—Finishing	Hydrated, per Ton—Common	Lump, per Barrel—Finishing	Lump, per Barrel—Common
New York	$17.20@18.20	$12.10	$3.25@3.50	$2.10@2.50
Chicago	20.00	18.00	....	1.50

LINSEED OIL—These prices are per 7½-lb. gallon:

	New York—Current	New York—One Year Ago	Chicago—Current	Chicago—One Year Ago
Raw in barrel (5 bbl. lots)	$0.76½	$0.81	$0.76	$0.84

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry—Current	Dry—1 Yr. Ago	In Oil—Current	In Oil—1 Yr. Ago
Red	13.75	15.25	15.25	16.75
White	13.75	15.25	13.75	15.25

HOSE—Quotations at New York warehouses:

Fire Protection 50-Ft. Lengths
Underwriters' 2½-in. coupled, single jacket (net) ..... $0.68 per ft.

Air—Best Grade
¾-in., per ft. ..... 3 ply $0.36½ 4 ply $0.44

Steam—Discounts from List
First grade ... 30–10% Second grade ..... 40% Third grade 45%

RUBBER BELTING—List price 6-in., 6 ply, $1.83 per lin.ft. for rubber transmission belting. Discounts from list are as follows:
Best grade ..... 45% Second grade 50%

LEATHER BELTING—List price, 24c. per lin.ft., per inch of width, for single ply at New York warehouses:

Grade	Discount from list
Medium	35%
Heavy	30%

PACKING—Prices per pound at New York warehouses:

Rubber and duck for low-pressure steam, ¼ in.	$0.95
Rubber sheet	.50
Rubber sheet, wire insertion	.80

MANILA ROPE—Per lb., ¼-in. and larger, 1,200-ft. coils:

Atlanta	$0.22	New Orleans	$0.23½
New York	.26	Seattle	.23
Chicago	23½	San Francisco	.23

EXPLOSIVES—Prices per pound for dynamite in small lots:

	Gelatin—40%	Gelatin—60%
New York	$0.265	$0.2875
Minneapolis	.1917	.2123
Denver	.2025	.2275
Seattle	.165	.19
Cincinnati	.22	.245
San Francisco	.1625	.1925

FLOTATION OIL—Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal $0.33

CHEMICALS—Prices for round lots in New York market, per lb.:

Zinc dust, 550 lb. casks	$0.09@.10
Litharge, casks	.09
Sodium cyanide, 220 lb. single case lots	.18@.22
Calcium carbide, in drums	.05@.06